

Project Manual

for



Tomball High School CTE and Miscellaneous Renovations

Tomball Independent School District

*November 6, 2023
Issued for Proposal*

*Texas Arcadis Inc. Project No.: **202311***

*Tomball ISD Request for Proposal No.: **950-23***



ARCADIS
10205 Westheimer Rd., Suite 800
Houston TX 77042 USA
281|286|6605
Arcadis.com

Tomball High School CTE and Miscellaneous Renovations

Tomball Independent School District

Date: November 6, 2023

Texas Arcadis Inc. Project No.: 202206

Tomball ISD RFP# 950-23

Board of Trustees

Lee McLeod	President
John E. McStravic	Vice President
Justin Unser	Secretary
Mark Lewandowski	Assistant Secretary
Dr. Michael Pratt	Trustee
Tina Salem	Trustee
Matt Schiel	Trustee

Executive Assistants

Janice Tadlock	Executive Assistant Superintendent
Linda Stoll	Executive Assistant Office of School Leadership

Executive Team

Dr. Martha Salazar-Zamora	Superintendent of Schools
Dr. Amy Schindewolf	Chief of Staff
Dr. Steven Gutierrez	Chief Operating Officer
Dr. Michael Webb	Chief Academic Officer
Mr. Zach Boles	Chief Financial Officer
Dr. Mindy Munoz	Assistant Superintendent of Secondary Schools
Dr. George Flores	Assistant Superintendent of Elementary Schools
Dr. Lee Wright	Assistant Superintendent of Strategic Innovation
Mark White	Assistant Superintendent of Accountability
Dr. Alicia Reeves	Assistant Superintendent of Human Talent
James Ross	Director of Construction

Tomball High School CTE and Miscellaneous Renovations

Tomball Independent School District

Date: November 6, 2023

Texas Arcadis Inc. Project No.: 202206

Tomball ISD RFP# 950-23

Tomball ISD Program Manager

Lockwood, Andrews & Newnam, Inc.
2925 Briarpark Drive
Houston, Texas 77042
713/266-6900

Consultants

Structural Engineer
CJG Engineers
3200 Wilcrest Dr., Suite 305
Houston, Texas 77042
713/780-3345

Civil Engineers
Auric Engineers, LLC
520 Post Oak Blvd., Suite 895
Houston, Texas 77027
713/405-1901

MEP Consultant
Salas O'Brien
10930 W Sam Houston Parkway, Suite 900
Houston, Texas 77064
281/664-1900

Food Service
Foodservice Design Professionals
26215 Oak Ridge North
The Woodlands, Texas 77380
281/350-2323

TABLE OF CONTENTS

Tomball High School CTE and Misc. Renovations Tomball ISD



I. PROPOSAL DOCUMENTS

November 6, 2023

Tomball Independent School District
Proposal #950-23 Issued November 6, 2023
Request for Competitive Sealed Proposals for the RENOVATION OF AN EXISTING PRE-ENGINEERED METAL BUILDING TO ACCOMMODATE CTE PROGRAMS FOR WELDING, FLORAL ARRANGEMENT AND OTHER PROGRAMS

AF	Subcontractor / Manufacturer Prequalification.....	1-4
AG	Affidavit of Non-Discriminatory Employment.....	1
AH	Indemnity and Hold Harmless Agreement.....	1
AI	Waiver, Release, and Indemnity Agreement	1-2
AL	Certification of Project Compliance.....	1-2
AN	Proposal Phase Procedures.....	1-2

II. CONTRACT FORMS

BB	Performance Bond Form	1-2
BC	Payment Bond Form.....	1-2
CD	Right to Audit.....	1-3

III. SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

01 10 00	Summary of Work.....	1-3
01 22 00	Unit Prices	1-2
01 23 00	Alternates	1-4
01 25 00	Request for Substitution Procedures	1-5
01 26 00	Contract Administration Document Management	1-7
01 29 73	Schedule of Values.....	1-8
01 29 76	Progress Payment Procedures.....	1-4
01 31 00	Project Management Software	1-6
01 31 13	Project Coordination	1-5
01 31 19	Project Meetings.....	1-3
01 31 29	Notification of Architect Requirements.....	1-3
01 32 16	Construction Progress Schedule CPM Required.....	1-8
01 33 00	Submittal Procedures	1-5

01 35 23	Owner Site Rules	1-2
01 36 13	Cutting and Patching.....	1-5
01 36 16	Remodeling and Alteration Procedures	1-4
01 42 13	Abbreviations and Acronyms	1-3
01 45 23	Testing and Inspection Services	1-7
01 45 23.13	Observation Procedures (A/E Team).....	1-3
01 50 00	Temporary Facilities and Controls	1-6
01 56 39	Temporary Tree and Plant Protection	1-5
01 57 13	Erosion and Sediment Controls	1-10
01 71 36	Protection of Existing Construction	1-3
01 77 00	Close-Out Procedures	1-13
01 77 00 B	Close Out AIA Attachments	1-3
01 77 00 C	Tx Arcadis Affidavit Attachments	1-5
01 78 23	Operating and Maintenance Manuals	1-5

DIVISION 2 – EXISTING CONDITIONS

02 32 00	Geotechnical Investigation.....	1-XX
02 41 19	Selective Demolition	1-3

DIVISION 3 - CONCRETE

03 15 19	Below Slab Vapor Membrane Slab on Grade Foundation	1-6
03 30 00	Cast-in-Place Concrete	1-13

DIVISION 4 - MASONRY

04 01 20.91	Unit Masonry Restorative.....	1-6
04 05 00	Concealed Masonry Lintel System	1-6
04 20 00	Unit Masonry.....	1-15

DIVISION 5 - METALS

05 12 00	Structural Steel Framing	1-5
05 41 00	Structural Metal Stud Framing	1-5
05 50 00	Metal Fabrications	1-6
05 52 13	Pipe and Tube Railing.....	1-5

DIVISION 6 - WOOD AND PLASTICS

06 10 13	Rough & Finish Carpentry.....	1-5
----------	-------------------------------	-----

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

07 13 63	Shower Stall Waterproofing	1-3
07 19 00	Water Repellants	1-3
07 21 00	Thermal Insulation	1-6
07 56 16	Fluid Applied Roofing (over metal building roof panels)	1-8
07 62 13	Sheet Metal Flashing (Pre-Finished)	1-11
07 65 26	Self-Adhering Sheet Flashing	1-5
07 72 00	Roof Accessories.....	1-5
07 92 00	Joint Sealants	1-5
07 95 00	Expansion Joint Covers.....	1-5

DIVISION 8 - DOORS AND WINDOWS

08 11 13	Hollow Metal Doors and Frames	1-7
08 14 23.16	Plastic-Laminate-Faced Wood Doors	1-6
08 31 13	Access Doors	1-4
08 33 23	Overhead Coiling Doors	1-5
08 33 23.13	Overhead Insulating Coiling Doors	1-6
08 56 19	Interior Transaction Windows	1-6
08 71 00	Door Hardware	1-4
08 80 00	Glazing and Aluminum Frames	1-13
08 80 00	Glazing	1-16
08 87 23	Safety and Security Films	1-7
08 90 00	Louvers and Vents.....	1-3

DIVISION 9 - FINISHES

09 21 16	Gypsum Board Assemblies	1-13
09 30 13	Ceramic Tiling.....	1-7
09 51 13	Acoustical Tile Ceilings.....	1-7
09 61 43	Concrete Floor Sealer	1-3
09 65 19	Resilient Tile Flooring	1-7
09 68 19	Carpet (Factory Applied Adhesive).....	1-3
09 73 00	Wall Protection System	1-3
09 77 83	Cementitious Wood Fiber Wall Panels	1-2
09 84 33	Sound-Absorbing Wall Units.....	1-3
09 91 00	Painting and Re-Painting (SW).....	1-9

DIVISION 10 - SPECIALTIES

10 11 16	Markerboards	1-3
10 11 23	Tackboards.....	1-3
10 12 00	Manufactured Display Cases.....	1-3
10 14 00	Signage	1-5
10 21 13.19	Plastic Toilet Compartments.....	1-5

10 22 13	Wire Mesh Partitions.....	1-3
10 26 13	Corner Guards and Crash Rails.....	1-3
10 44 00	Toilet, Bath and Laundry Accessories.....	1-6
10 44 13	Fire Extinguisher and Cabinets.....	1-3
10 51 13.13	Metal Lockers and Wood Benches	1-6

DIVISION 11 - EQUIPMENT

11 31 00	Residential Appliances.....	1-4
11 40 00	Food Service Equipment (THS Equipment Package).....	1-X
11 57 00	Vocational Shop Equipment.....	1-3

DIVISION 12 - FURNISHINGS

12 21 13	Horizontal Louver Blinds (Alternate 2)	1-3
12 32 16	Manufactured Plastic-Laminate-Clad Casework (Educational)	1-14

DIVISION 13 - SPECIAL CONSTRUCTION

13 34 19.13	Wall Panels for Pre-Engineered Building	1-3
-------------	---	-----

DIVISION 14 - CONVEYING SYSTEMS

Not Used

DIVISION 21 – FIRE PROTECTION

21 01 00	Fire Protection Operating and Maintenance Manuals.....	1-3
21 05 00	Fire Protection General Provisions	1-6
21 05 10	Fire Protection Contract Quality Control	1-2
21 05 12	Fire Protection Shop Drawings, Coordination Drawings & Product Data	1-5
21 05 13	Electrical Provisions of Fire Protection Work	1-3
21 05 14	Fire Protection Alterations Project Procedures	
21 10 00	Fire Protection System.....	1-13

DIVISION 22 - PLUMBING

Section

22 01 00	Plumbing Operating and Maintenance Manuals	1-3
22 05 00	Plumbing General Provisions.....	1-6
22 05 10	Plumbing Contract Quality Control.....	1-2
22 05 12	Plumbing Shop Drawings, Coordination Drawings & Product Data ...	1-5
22 05 13	Electrical Provisions of Plumbing Work.....	1-3
22 05 15	Plumbing Earthwork.....	1-1

22 05 16	Excavating, Backfilling and Compacting for Utilities Outside Building Slab.....	1-3
22 05 17	Plumbing Access Doors	1-2
22 05 19	Pressure and temperature Instruments for Plumbing Piping	1-3
22 05 23	Valves, Strainers, and Vents	1-6
22 05 33	Pipe Heat Tracing for Plumbing Piping.....	1-3
22 07 19	Plumbing Piping Insulation	1-6
22 08 00	Plumbing Commissioning Coordination.....	1-3
22 11 16	Domestic Water Piping and Appurtenances	1-4
22 13 16	Soil, Waste and Sanitary Drain Piping, Vent Piping and Appurtenances	1-5
22 14 13	Roof Drainage Piping and Appurtenances	1-3
22 20 00	Plumbing Pipe and Pipe Fittings – General	1-8
22 33 33	Electric Water Heater	1-2
22 40 00	Plumbing Fixtures & Fixture Carriers.....	1-4
22 63 11	Natural Gas Piping and Appurtenances	1-4

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

23 01 00	HVAC O&M Manuals.....	1-4
23 05 00	Mechanical General Provisions	1-6
23 05 12	HVAC Shop Drawings, Coordination Drawings & Product Data	1-5
23 05 13	Electrical Provisions of HVAC Work	1-3
23 05 14	HVAC Condensate Drain Piping.....	1-1
23 05 17	HVAC Access Doors	1-2
23 05 48	Vibration Isolation	1-3
23 05 93	Testing Adjusting and Balancing	1-12
23 05 94	Coordination of TAB	1-3
23 07 13	External Duct Insulation.....	1-5
23 08 00	HVAC Commissioning Coordination.....	1-8
23 09 33	Building Management and Control System	1-45
23 23 00	Refrigerant Piping and Appurtenances.....	1-2
23 31 13	Ductwork	1-13
23 34 16	Fans	1-4
23 36 16	Variable Volume Terminal Units	1-6
23 37 13	Air Devices	1-2
23 41 00	Air Filtration	1-2
23 55 33	Gas-Fired Unit Heaters.....	1-6
23 74 15	Package Rooftop Variable Air Conditioners	1-9
23 81 18	Single Package Rooftop Air Conditioners (100% Outside Air)	
23 81 19	Single Package Rooftop Air Conditioners.....	
23 82 16	Heating & Cooling Coils.....	1-3
23 82 18	Ductless Mini-Split DX Units	1-5
23 82 19	Fan Coil Units	1-4
23 82 39	Electric Duct Heaters.....	1-2

DIVISION 26 - ELECTRICAL

26 01 05	Electrical Operating and Maintenance Manuals.....	1-4
26 05 00	Electrical General Provisions	1-16
26 05 05	Electrical Alterations Project Procedures	
26 05 08	Telecommunications, CATV, Voice, Data, Video Utility Coordination and Service Entrance	1-2
26 05 10	Electrical Contract Quality Control	1-4
26 05 12	Electrical Shop Drawings, Coordination Drawings & Product Data....	1-5
26 05 16	Excavating, Backfill, and Compacting for Electrical	1-2
26 05 19	Conductors and Connectors-600 Volt.....	1-6
26 05 27	Expansion of Existing Electrical Grounding	1-6
26 05 33	Conduit Systems.....	1-15
26 05 35	Electrical Connections for Equipment	1-2
26 05 37	Electrical Boxes and Fittings	1-5
26 05 38	Electrical Floor Boxes and Fittings.....	1-3
26 05 40	Electrical Gutters and Wireways	1-2
26 05 50	Firestops	1-1
26 08 00	Electrical Commissioning Coordination.....	1-3
26 09 25	Electrical Contactors.....	1-2
26 09 43	Lighting Controls	1-10
26 12 17	Ultra-High Efficiency Transformers	1-7
26 19 13	Combination Motor Controllers	1-3
26 24 16	Panelboards and Enclosures	1-5
26 24 25	Enclosed Switches and Circuit Breakers	1-4
26 24 30	Fuses	1-1
26 27 73	Wiring Devices	1-8
26 43 00	Surge Protection Devices	1-5
26 51 13	Lighting Fixtures	1-6

DIVISION 27 – COMMUNICATIONS

27 01 00	Communications Operating and Maintenance (O&M) Manuals of Communications Systems	1-3
27 05 00	Communications Basic Materials, Methods, and General Provisions	1-17
27 05 05	Communications Alterations Project Procedures.....	
27 05 07	Communications Shop Drawings, Coordination Drawings & Product Data	1-5
27 05 09	Contract Quality Control.....	1-2
27 10 00	Data Communications Structured Cabling System (SCS)	1-15
27 50 00	Expansion of Existing School Communication System.....	

DIVISION 28 – SAFETY AND SECURITY

28 01 00	Operation and Maintenance (O&M) Manuals of Electronic Safety and Security Systems.....	1-3
28 05 00	Safety and Security Basic Materials, Methods, and General Provisions	1-15
28 05 05	Electronic Safety and Security Alterations Project Procedures.....	
28 05 07	Shop Drawings, Coordination Drawings & Product Data	1-5
28 05 10	Contract Quality Control	1-2
28 10 00	Access Control System (ACS).....	1-6
28 20 00	Video Surveillance System (VSS)	1-25
28 23 05	Expansion of Existing Intrusion Detection System (IDS) - Bosch	1-15

DIVISION 31 - EARTHWORK

31 11 00	Clearing and Grubbing	1-5
31 22 13	Site Grading.....	1-10
31 23 33	Trenching, Backfilling, and Compaction	1-8
31 32 13.19	Lime Soil Stabilization	1-6
31 32 13.26	Lime-Fly Ash or Fly Ash Stabilization	1-6
31 41 33	Trench Safety	1-5

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 13 13	Concrete Paving	1-11
32 17 23.13	Painted Pavement Markings.....	1-3
32 18 16	Synthetic Grass Surfacing	1-7
32 31 13	Chain Link Fences and Gates	1-5
32 92 00	Turf and Grasses.....	1-6

DIVISION 33 – UTILITIES

33 10 00	Water Distribution	1-11
33 30 00	Sanitary Sewer	1-12
33 40 00	Storm Drainage	1-11

IV. INDEX OF DRAWINGS

<u>SHEET NO.</u>	<u>SHEET NAME</u>
G1.00	GENERAL/CODE INFORMATION
G1.01	CODE ANALYSIS
G1.02	1ST FLOOR LIFE SAFETY PLAN
SV0.01	TOPOGRAPHIC SURVEY
CA0.01	SITE DEMO PLAN
CA1.01	SITE DETAILS
CA1.02	SITE PLAN
C1.00	GENERAL NOTES
C1.01	PLAT
C1.03	SITE DEMOLITION PLAN
C1.04	SITE DIMENSIONAL PLAN
C2.01	CIVIL SITE PLAN
C2.02	SITE EROSION CONTROL PLAN
C2.03	SITE PAVING AND JOINTING PLAN
C2.04	FIRE APPARATUS ACCESS PLAN
C3.00	SITE GRADING PLAN
C4.00	DRAINAGE AND UTILITY PLAN
C7.01	CIVIL DETAILS
C7.02	CIVIL DETAILS
C7.03	CIVIL DETAILS
S0.00	GENERAL NOTES
S0.01	GENERAL NOTES
S0.02	TEST NOTES
S0.03	UPLIFT KEYPLAN
SD1.01	DEMO FOUNDATION PLAN
S1.00	COMPOSITE FOUNDATION PLAN
S1.01	AREA 'A' FOUNDATION PLAN
S1.02	AREA 'B' FOUNDATION PLAN
S2.01	ROOF FRAMING DETAILS
S2.02	FOUNDATION DETAILS
S3.01	FRAMING DETAILS

A0.01	DEMO PLAN
A1.01	1ST FLOOR COMPOSITE PLAN
A2.01	AREA 'A1' 1ST FLOOR PLAN
A2.02	AREA 'B1' 1ST FLOOR PLAN, SCHEDULES, & ENLARGED RESTROOMS
A4.00	ROOF PLAN
A6.00	PARTITION TYPES & WALL SECTIONS
A7.01	ELEVATIONS
A8.00	CASEWORK ELEVATIONS & SECTIONS
A9.01	FRAME ELEVATIONS & OPENING DETAILS
A10.01	AREA 'A' 1ST FLOOR RCP
A10.02	AREA 'B' 1ST FLOOR RCP
A11.00	INTERIOR FINISH PLAN & LEGEND
A12.00	SIGNAGE FLOOR PLAN
A12.01	SIGNAGE DETAILS
M1.01	MECHANICAL DEMOLITION AREA 'A1' 1ST FLOOR PLAN
M2.01	MECHANICAL AREA 'A1' 1ST FLOOR PLAN
M2.02	MECHANICAL AREA 'B1' 1ST FLOOR PLAN
M3.01	MECHANICAL DETAILS AND LEGENDS
M3.02	MECHANICAL DETAILS AND LEGENDS
M4.01	MECHANICAL SCHEDULES
E1.00	ELECTRICAL SITE PLAN
E1.01	ELECTRICAL DEMOLITION AREA 'A1' 1ST FLOOR PLAN
E1.02	ELECTRICAL DEMOLITION AREA 'B1' 1ST FLOOR PLAN
E2.01	ELECTRICAL LIGHTING AREA 'A1' 1ST FLOOR PLAN
E2.02	ELECTRICAL LIGHTING AREA 'B1' 1ST FLOOR PLAN
E3.01	ELECTRICAL POWER AREA 'A1' 1ST FLOOR PLAN
E3.02	ELECTRICAL POWER AREA 'B1' 1ST FLOOR PLAN
E4.01	ELECTRICAL ONE-LINE DIAGRAM
E5.01	ELECTRICAL PANEL SCHEDULES
E5.02	ELECTRICAL PANEL SCHEDULES
E6.01	ELECTRICAL DETAILS AND SCHEDULES
P1.00	PLUMBING SITE PLAN
P1.01	PLUMBING DEMOLITION AREA 'A1' 1ST FLOOR PLAN
P2.01	PLUMBING UNDERFLOOR AREA 'A1' 1ST FLOOR PLAN
P2.02	PLUMBING UNDERFLOOR AREA 'B1' 1ST FLOOR PLAN
P3.01	PLUMBING AREA 'A1' 1ST FLOOR PLAN
P3.02	PLUMBING AREA 'B1' 1ST FLOOR PLAN
P5.01	PLUMBING DETAILS
P5.02	PLUMBING DETAILS
P6.01	PLUMBING SCHEDULES

T0.00	TECHNOLOGY NOTES AND LEGENDS
T1.01	TECHNOLOGY DEMOLITION AREA 'A1' 1ST FLOOR PLAN
T1.02	TECHNOLOGY DEMOLITION AREA 'B1' 1ST FLOOR PLAN
T2.01	TECHNOLOGY AREA 'A1' 1ST FLOOR PLAN
T2.02	TECHNOLOGY AREA 'B1' 1ST FLOOR PLAN
T3.01	TECHNOLOGY ENLARGED PLANS
T4.01	TECHNOLOGY DETAILS
T4.02	TECHNOLOGY DETAILS
T4.03	TECHNOLOGY DETAILS
T4.04	TECHNOLOGY DETAILS

SECTION AF

SUBCONTRACTOR / MANUFACTURER PREQUALIFICATION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. The Contract Documents – Drawings and Specifications – are produced and based on specific manufacturer's materials and assemblies, including proper interface with adjacent materials and assemblies. The 'basis of design' manufacturer and product is identified in each Section of Specifications or as noted on the Drawings.
 - 01 Unless specifically defined as 'proprietary' or 'no substitutions', other acceptable manufacturers are listed in the Specification Section.
 - 02 These manufacturers have previously demonstrated a superior level of product and service and are therefore listed as 'Acceptable' Manufacturers.
- C. In addition to a specific manufacturer's material / product used as the Basis of Design, certain Sections of the Specifications list Acceptable Subcontractors. These Sub-contractors have previously demonstrated a superior level of workmanship, capability, and service.
- D. It is not the intent to limit competition or exclude other qualified manufacturers or sub-contractors from proposing on the Work; however, those requesting to be added to an 'acceptable' list are required to provide documentation for evaluation by the Architect or Consultant prior to submitting a bid / proposal to a General Contractor.

PART 2 - MANUFACTURERS

2.1 ACCEPTABLE MANUFACTURER LISTINGS

- A. The materials, products and equipment described in the Proposal Documents establish a standard of required function, properties, dimension, appearance and quality to be met by any proposed substitution.
 - 01 The manufacturer, products and equipment named as the Basis of Design, and the procedures covered by these Specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance.
- B. In Sections where a particular manufacturer's product is used as the "Basis for Design", that product and other specified descriptions shall establish the minimum requirements, performance criteria and attributes necessary to meet the Contract Document requirements.

- 01 Where manufacturer and or product are specified as “no substitutions”, only the specified manufacturer and product shall be acceptable to include in a Proposal.
- C. In Sections that have additional acceptable manufacturers listed, those manufacturers have been included based on historical data of providing quality products and assemblies.
- D. It is entirely incumbent on the other listed acceptable manufacturers to propose on and provide products, materials, equipment and / or assembly(s) which fully meet or exceed the ‘Basis of Design’ product, attributes, performance, and all other specified requirements.
 - 01 By submitting a proposal / bid to a General Contractor, a listed acceptable manufacturer is affirming that their proposal / bid meets or exceeds the ‘Basis of Design’ material / product / assembly and all specified requirements.
- E. The lists are not all inclusive nor is there any warranty, express or implied, on the part of the Owner, Architect, or his Consultants that the Subcontractors and / or manufacturers listed shall perform satisfactorily on this Project, nor that they are financially sound at the present time. Since it is required that the Contractor shall have the Contractor-Subcontractor relationship required by the Contract Documents with his Subcontractors, it is imperative that he be satisfied with the ability and financial strength of the listed Subcontractors.

2.2 PROCEDURES DURING BIDDING / PROPOSAL PERIOD

- A. The acceptable manufacturers lists are not all inclusive; and such lists are not intended to restrict competition or exclude otherwise qualified manufacturers from submitting bids. Accordingly, Proposers may submit for consideration the names and qualifications of other manufacturers / providers which they feel are qualified by following the procedure enumerated below.
- B. Each manufacturer / provider requesting to be added to the acceptable list of manufacturers included in individual Specification Sections must submit the following qualification information a minimum of ten (10) days prior to the proposal date.
 - 01 Submit information to the Architect and relative A/E Consultant as applicable.
 - 02 Submissions shall be accepted only in electronically in PDF format.
 - 03 Faxed or telephonic submissions shall not be accepted.
- C. For a manufacturer's product to be considered for acceptance, the following material must be submitted to the Architect or relative Consultant, as applicable, not later than ten (10) calendar days prior to the date set for the receipt of proposals from General Contractors:
 - 01 Name of manufacturer, contact person, phone number and email address.
 - 02 Provide the Specification Section number(s) and the specific specified product for which the substitution request is being made.
 - 03 Submit a copy of the printed project Specification Section with each and every paragraph and statement initialed by the submitter that their proposed product shall meet or exceed the specified properties, attributes and / or performance criteria. Where proposed products may deviate from the Specification, clearly indicate so; and submit / describe in detail what alternatively is proposed to be accepted.

- 04 Provide complete and specific product data for the proposed product, including but not limited to like information, performance criteria, test results, etc. established for the "Basis of Design" product and accompanying Specifications. Submission of general documentation that does not specifically identify only the proposed substitution shall not be accepted.
- 05 If the proposed product alters an assembly, detail or interface with adjacent materials as described in the Contract Documents, provide graphic illustration of the revised assembly, detail or interface with adjacent materials. Submission of general or generic documentation / details that do not specifically relate to this project shall not be accepted.
- 06 Other supporting documentation the submitter wants to be included in the evaluation process.
- D. Submissions which fail to clearly delineate the specific information to be considered shall not be considered for acceptance; nor will the submitter be notified to correct the deficiency of the submitted material.
- E. A submitted product found to be acceptable for use in this Project shall be included by Addendum. No other form of approval shall allow the product to be substituted.
- F. Proposers shall include in their proposal only manufacturers that are listed as the Basis of Design or listed as an acceptable manufacturer in the Specifications, or subsequently included in an Addendum as being acceptable.

PART 3 - SUBCONTRACTORS

3.1 ACCEPTABLE SUBCONTRACTOR LISTINGS

- A. Certain Sections of the Specifications may list Acceptable Subcontractors. For the Work included in those Sections, Proposals must include one of the Sub-Contractors listed. Where a Specification Section does not include a list of Acceptable Subcontractors, the General Contractor / Proposer is free to utilize any Subcontractor that the General Contractor feels is an acceptable Subcontractor.
- B. The Subcontractors listed as acceptable have been selected because of a demonstrated ability to acceptably perform the Work required for a project of this type and size within the allowable time anticipated for construction. It is not intended to preclude the use of other equally or better qualified Subcontractors provided that same meet the requirements of this particular project.
- C. The lists are not all inclusive nor is there any warranty, express or implied, on the part of the Owner, Architect, or his Consultants that the Subcontractors and / or manufacturers listed shall perform satisfactorily on this Project nor that are they financially sound at the present time. Since it is required that the Contractor shall have the Contractor-Subcontractor relationship required by the Contract Documents with his Subcontractors, it is imperative that he be satisfied with the ability and financial strength of the listed Subcontractors.

3.2 PROCEDURES DURING BIDDING / PROPOSAL PERIOD

- A. Any Proposer desiring to have a Subcontractor included in the list of Acceptable Subcontractors shall have the Subcontractor submit qualification

information to the Architect or pertinent Consultant as applicable for evaluation to be accepted to provide work on this project.

- B. Each manufacturer requesting to be added to the acceptable list of manufacturers included in individual Specification Sections must submit the following qualification information a minimum of ten (10) days prior to the proposal date.
- 01 Submit information to the Architect and relative A/E Consultant as applicable.
 - 02 Submissions shall be accepted only in hard copy or electronically in PDF format.
 - 03 Faxed or telephonic submissions shall not be accepted.
- C. For a proposed Subcontractor to be considered for acceptance the following material must be submitted to the Architect or relative Consultant, as applicable, not later than ten (10) calendar days prior to the date and time set for the receipt of proposals from general contractors:
- 01 Name of Subcontractor, contact person, phone number and email address.
 - 02 Provide the Specification Section number(s) and the specific trade(s) for which the substitution request is made for.
 - 03 Submit a copy of the printed project Specification Section with each and every paragraph and statement initialed by the submitter that their proposed product shall meet or exceed the specified properties, attributes and / or performance criteria. Where proposed products may deviate from the Specification, clearly indicate so; and submit / describe in detail what alternatively is proposed to be accepted.
 - 04 Provide a completed Qualification Statement (AIA Document A305).
 - 05 A list of at least five (5) projects of similar scope as the project being proposed on, which have been completed in the last five (5) years. Submitted information for each project shall include the following information:
 - a. Project name and location.
 - b. General Contractor's project manager name and contact information (current phone number and email address)
 - c. Architect's project manager name and contact information (current phone no. and email address).
 - 06 A list of at least three (3) references of General Contractors and three (3) Architects which the proposer has completed work for in the last five (5) years including contact information (current phone number and email address).
 - 07 Other supporting information the proposed Subcontractor wants to be considered in the evaluation process.
- D. A Subcontractor found to be acceptable for use on this project shall be included by Addendum. No other form of approval shall allow the Subcontractor to be substituted.
- E. Proposers shall include in their proposal only Subcontractors that are listed as acceptable in the Specifications, or subsequently included in an Addendum as being acceptable.

END OF SECTION

AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

SECTION AH
INDEMNITY AND HOLD HARMLESS AGREEMENT

STATE OF TEXAS)
)
COUNTY OF _____)

This Agreement is made by and between Tomball Independent School District (called "Owner")

and _____ (called "Contractor"),
(company)

to be effective from its date of execution, in which Contractor, as condition precedent to its engagement to perform, supervise, and subcontract particular work on behalf of Owner referred to for all purposes as the WEST INTERMEDIATE SCHOOL (called "Project") agrees to indemnify and hold harmless Owner, its Board of Trustees, individually and in their capacities, and all employees and agents of Owner, from any and all claims, actions, demands, suits, causes or otherwise, for personal injury, death or property damage, arising out of or related directly or indirectly to the Project, brought by or on behalf of any person, group of persons, or legal entity.

All Contracts and other documents relating to the Project are hereby incorporated herein and deemed to be a part hereof by reference. Further, Contractor agrees that the consideration which it is to receive for the performance of work under Project be deemed adequate consideration for the execution of this indemnity and hold harmless agreement, of which it forms an integral part.

Executed in duplicated originals this _____ day of _____, 20_____.

By:

Its Authorized Representative

CONTRACTOR

TOMBALL INDEPENDENT SCHOOL DISTRICT

By:

Its Authorized Representative
OWNER

END OF SECTION

SECTION AI

WAIVER, RELEASE AND INDEMNITY AGREEMENT

Whereas, the following entities:

Texas Arcadis, Inc., hereinafter called "Architect"	Architectural
Auric Engineers, hereinafter called "Consultant"	Civil
Salas O'Brien, hereinafter called "Consultant"	MEP
CJG Engineers, hereinafter called "Consultant"	Structural
FDP Food Service Design Professionals, hereinafter called "Consultant"	Food Service

have utilized certain electronic AutoCAD and / or Revit model files in preparation of drawings for the Project, Tomball High School CTE & Misc. Renovations, on behalf of TOMBALL Independent School District, the "Owner", and

Whereas, _____, a Subcontractor/Contractor for _____ or _____, a subtier contractor to _____ hereafter "Subcontractors" desires to obtain copies on magnetic disk of certain of the Architects and / or Consultant's computer aided drafting (AutoCAD) files Revit model(s) consisting of construction drawings for the Project, hereinafter, "Electronic Media," and

Whereas, Architect and / or Consultant is willing to provide copies for the convenience of Subcontractors only under certain express conditions of understanding, acknowledgment and covenant as hereinafter provided without qualification.

Now therefore, Architect and Subcontractor agree as follows:

1. **ACKNOWLEDGEMENT AND LIMITATIONS:** It is acknowledged that (1) Architect's and / or Consultant's instruments of professional serves are the hard copy Drawings and Specifications issued by Architect hereinafter "Instrument", (2) the Electronic Media are not substitutions for said Instruments, (3) differences may exist between said Instruments and the Electronic Media which Architect and / or Consultant is under no obligation to discover or disclose if known, (4) the Electronic Media may be incompatible with the Subcontractor's software and hardware configurations. In all ways, including those enumerated, Subcontractors accept the Electronic Media "as is" and Architect and / or Consultant is under no obligation to correct, update for changes, enhance or maintain the Electronic Media for Subcontractors. Architect does not represent or warrant that the Electronic Media are complete, free from defects, or accurate now or in the future. It is acknowledged, finally, that no client relationship is created by or through this instrument between Architect and / or Consultant and Subcontractors.

2. **WAIVER AND RELEASE:** Subcontractors agree all risk of incomplete, inaccurate, defective and variant information contained in the Electronic Media, and waives, quits, and forever discharges and releases the Owner, the Architect and / or Consultant and there officers, directors, employees and successors for every claim arising out of or related to any error, discrepancy, inaccuracy, variation or other defect in the Electronic Media, whether or not resulting in whole or in part from an act, error or omission of the Architect and / or Consultant and whether or not such claim is known or unknown as of the date of this waiver and release.

3. **REUSE:** The Electronic Media is not reusable for any other project or for additions or extensions of the project identified in the Electronic Media. Architect and / or Consultant does not authorize release of the Electronic Media to any person or party other than the Subcontractors, and the Subcontractors agree and covenant not to release the Electronic Media to any other party.

4. INDEMNIFICATION: Use of the Electronic Media shall be at the sole risk of the Subcontractors and without liability or legal expense to the Owner or the Architect and / or Consultant; further, Subcontractors shall, to the fullest extent permitted by law, defend, indemnify and hold the Owner, the Architect and / or Consultant and its officers, directors, employees and successors harmless from all claims, damages, including bodily injury or death, losses and expenses, including attorney fees, arising out of or resulting in whole or in part from the use of the Electronic Media.

5. DISPUTES: Due to the risk of damage, anomalies in transcription or copying and modification during use by Subcontractors where intended or otherwise, it is agreed the Architect and / or Consultant's archived copy of the Electronic Media, if Architect and / or Consultant chooses to maintain same shall be conclusive, un-rebuttable proof in all disputes over the content of the Electronic Media furnished to Subcontractors by this Agreement.

Wherefore, the parties have signed this Release, Waiver and Indemnify Agreement on the

_____ Day of _____, 20_____.

ARCHITECT:

TEXAS ARCADIS, INC.

By: _____

Title: _____

Date: _____

CONSULTANT:

By: _____

Title: _____

Date: _____

CONTRACTOR:

By: _____

Title: _____

Date: _____

SUBCONTRACTOR:

By: _____

Title: _____

Date: _____

END OF SECTION

FORM AL

**CERTIFICATION
OF PROJECT
COMPLIANCE**

Distribution to:

District	<input type="checkbox"/>	Architect/Engineer	<input type="checkbox"/>
Contractor	<input type="checkbox"/>	Texas Education Agency	<input type="checkbox"/>
Other	<input type="checkbox"/>	Building Department	<input type="checkbox"/>

1. PROJECT INFORMATION:

Tomball High School CTE & Misc.
Renovations
30330 Quinn Road
Tomball, Texas 77375

ARCHITECT/ENGINEER:

Texas Arcadis, Inc.
10205 Westheimer Rd., Suite 800
Houston, Texas 77042

CONTRACTOR/CM:

PROJECT NUMBER: 202311

CONTRACT DATE:

DISTRICT: Tomball Independent School District
310 S. Cherry Street
Tomball, Texas 77375

DATE DISTRICT AUTHORIZES PROJECT: November 6, 2023

BRIEF DESCRIPTION OF PROJECT:

Conversion of Existing Prefab Ag Barn into a CTE Facility with associated Site work. Kitchen Equipment Package for Tomball High School

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the enrollment projections, educational specifications and objectives of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: Tomball I.S.D.

BY:

DATE:

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the State Board of Education, July 1992, and as provided by the district.

ARCHITECT/ENGINEER: Texas Arcadis

BY:

DATE:

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM:

BY:

DATE:

5. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: Tomball I.S.D.

BY:

DATE:

INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM

Section 1. Identify the following:

- name and address of the school facility
- the Architect/Engineer and Contractor
- the school district's project number (if applicable)
- the date of execution of the construction contract
- name, address, and telephone number of the school district
- the date that the school district authorized the superintendent to hire an architect/engineer
- scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.104, School Facilities Standards) and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

END OF FORM

SECTION AN

PROPOSAL PHASE PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 This Section contains procedures to be followed by General Contractor Proposers and Subcontractors / Material Suppliers during the proposal phase of the Project.
- C. Related Work:
 - 01 All Sections of Specifications contained in the Project Manual.
 - 02 All Drawings issued as Contract Documents.
 - 03 All Addenda issued during the proposal phase.

1.2 SUBMITTALS

- A. Refer to Tomball Independent School District - Proposal #950-23 Issued November 6, 2023. Request for Competitive Sealed Proposals for the Renovation of Tomball High School Pre-engineered Metal Building into a CTE Facility, and Tomball High School Kitchen Equipment Package.

1.3 QUALITY ASSURANCE

- A. The Proposer's Qualification Statement, including accompanying documents, is the primary tool used in the Competitive Sealed Proposal evaluation process. It is the Proposer's opportunity to demonstrate their strengths and qualifications.
- B. It is the Proposer's sole responsibility to provide complete information on all required qualification documents.
- C. It is the Proposer's sole responsibility to provide Qualification Statement, including accompanying documents in a timely manner to allow ample time to allow for reference inquiries and responses, and other evaluation processes.
 - 01 No attempt shall be made by the Architect to expedite responses from references submitted by the Proposer.
 - 02 Non-responses from Proposer's references shall have a negative impact on the Proposer in the evaluation process.
- D. It is the Proposer's sole responsibility to provide reference information that is current, accurate and viable.
 - 01 Proposers are highly encouraged to contact their submitted references, advise them they will be receiving a reference form, and to return it promptly to the Architect.
 - 02 Evaluation reference requests shall be distributed to Proposer's submitted references by email.

- 03 No attempt shall be made by the Architect to correct inaccurate information submitted by the Proposer.
- 04 No attempt shall be made by the Architect to contact Proposer or reference recipients for failure to return a response in a timely manner.

1.4 ON-LINE ACCESS TO PROJECT INFORMATION

- A. The RFP and all documents in total can be downloaded from the Tomball ISD Purchasing website, <https://www.tomballisd.net/about-tisd/departments/finance/purchasing/bids-and-proposals>. If you have trouble with the link go to the Tomball ISD website and at the "Find" bar type bids. This will take you directly to the procurement page. Contact the Program Manager if you encounter a problem: Lockwood, Andrews & Newnam, Inc (713) 266-6900.
- B. Proposers List / Bidder List, Addenda, and related documents: Lists / documents may be obtained at any time by the following procedures.
 - 01 Go to www.arcadiseducationtx.com
 - 02 Click on the Active Projects "hard hat" icon (bottom right of page) to access the active projects data base.
 - 03 Click on the desired project (listed by project number and name) highlighted as linkable.

PART 2 – PROCEDURES

2.1 PROPOSAL PHASE REQUEST FOR INFORMATION

- A. All requests for information during the Proposal Phase should be made in writing by email.
- B. Requests for information should be made directly to Texas Arcadis noting the responsible party / consultant:
 - 01 Architectural / General: Texas Arcadis, Inc: Stuart Campbell
Email: stuarte.campbell@arcadis.com
 - 02 Civil: Auric Engineers:
 - 03 MEP: Salas O'Brien Engineering :
 - 04 Structural: Conti Jumper Gardner: :
 - 05 Foodservice: FDP:
- C. All Proposal RFI's shall be responded to in writing by return email only to the original sender.
- D. Official changes to the Contract Documents originating from proposal RFI's shall be issued by Addendum to all plan holders.

2.2 ADDENDA

- A. As much as practical, all Addenda shall be issued by the architect.
- B. All Addenda shall be issued electronically to all plan rooms and plan holders registered with the Architect.
 - 01 All Addenda will be posted to the Owners' website for proposers' viewing.
 - 02 All Addenda will be posted to the architects' website for proposers' viewing.

END OF SECTION

SECTION BB

PERFORMANCE BOND FORM

STATE OF TEXAS

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENT, that we, _____,
a Corporation of the State of Texas, with home office and principal place of business in
_____, Texas, hereinafter called "Principal" and
_____, a Corporation of the State of
_____, hereinafter called "Surety" are held and firmly bond unto the
Tomball Independent School District, hereinafter called "Owner", in the amount of
_____ (\$_____) Dollars for
payment whereof the said principal and surety bind themselves and their heirs, administrators,
executors, successors and assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such that whereas the Principal has entered into a
certain Contract with the Tomball Independent School District, the Owner, dated the _____
day of _____, 20____, for the complete construction on the property of the Owner,
located in Harris County, Texas, of the Work described as:

TOMBALL HIGH SCHOOL CTE AND MISC. RENOVATIONS
FOR
TOMBALL INDEPENDENT SCHOOL DISTRICT

which said Contract and Documents referred to therein is herein now referred to and made a
part hereof as fully and completely as if copies in detail herein.

NOW, THEREFORE, the condition of this obligation is such that if said Principal shall
well and truly and faithfully perform all the undertakings, covenants, terms, conditions, and
agreements of said Contract, including, but not limited to, the faithful performance of the Work
required in accordance with the Plans and Specifications, during the original term thereof and
extension thereof which may be granted by the Owner with or without notice to the Surety, and
if said Principal shall satisfy all claims and demands incurred under such Contract and shall fully
indemnify and save harmless the Owner from all costs, damages and reasonable expenses
which it may suffer by reason of failure so to do and shall fully reimburse and repay the Owner
all outlay and expenses, including attorney's fees, which the Owner may incur in making good
any default, and shall reimburse and repay the Owner for all costs, including attorney's fees,
which the Owner may incur in the prosecution or defense of any suit or proceeding arising out of
the breach or default of the Principal, then this obligation shall be void; otherwise, to remain in
full force and effect.

The said Surety, for value received, hereby stipulates and agrees that no change,
extension of time, alterations or additions to the terms of the Contract or to the Work to be
performed thereunder or of the Specifications accompanying the same, shall in anyway affect
its obligation on this bond, and it does hereby waive notice of such change, extensions of time,
alterations or additions to the terms of the Contract or to the Work or to the Specifications
thereunder.

It is expressly provided that if any legal action shall be filed upon this bond, venue shall
lie in Harris County, Texas.

Simultaneously with the execution of this Performance Bond, the parties hereto have executed a Payment Bond, reference to which is made for all purposes. Nothing in this Performance Bond shall in any way invalidate or nullify the obligations of the parties as set forth in said Payment Bond.

Provided, however, that this bond is executed pursuant to the provisions of Texas Government Code Chapter 2253, and liabilities on this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copies at length herein.

Provided, however, that nothing in the bond shall be construed to limit the rights of the beneficiaries of this Bond which they might have under general, special or the common law of the State of Texas not inconsistent with the terms hereof and not inconsistent with the provisions of Texas Government Code Chapter 2253, as amended.

IN TESTIMONY WHEREOF, the parties hereto have executed this instrument on this _____ day of _____, 20 _____.

(Authorized Signature of Principal)

(Title)

APPROVED AS TO FORM:

ATTEST:

Owner: Tomball Independent School District

(Secretary of Principal's Corporation)

Attorney Representing Owner

(Authorized Signature of Surety)

(Title)

END OF SECTION

SECTION BC

PAYMENT BOND FORM

STATE OF TEXAS

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENT, that we, _____, a Corporation of the State of Texas, with home office and principal place of business in _____, Texas, hereinafter called "Principal" and _____, a Corporation of the State of _____, hereinafter called "Surety" are held and firmly bond unto the Tomball Independent School District, hereinafter called "Owner", for the use and benefit of all persons, firms and corporations who may furnish material or perform labor upon the buildings or improvements hereinafter referred to, in the penal sum of (\$ _____) Dollars, (the Contract Price), in lawful money of the United States of America, to be paid in _____, Texas for payment of which sum well and truly to be made we bind ourselves and our successors, jointly and severally, by these presents.

TOMBALL HIGH SCHOOL CTE AND MISC. RENOVATIONS
FOR
TOMBALL INDEPENDENT SCHOOL DISTRICT

which said Contract and Documents referred to therein is herein now referred to and made a part hereof as fully and completely as if copies in detail herein.

NOW, THEREFORE, the condition of this obligation is such that if the Principal shall promptly make payment to all persons, firms and corporations furnishing materials for, or performing labor in the prosecution of the Work provided for in such Contract, and any extension or modification thereof, then this obligation shall be void; otherwise to remain in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of Texas Government Code Chapter 2253, and liabilities on this bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copies at length herein.

Provided, however, that nothing in the bond shall be construed to limit the rights of the beneficiaries of this Bond which they might have under general, special or the common law of the State of Texas not inconsistent with the terms hereof and not inconsistent with the provisions of Texas Government Code Chapter 2253, as amended.

Said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or of the Specifications accompanying the same, shall in anyway affect its obligation on this bond, and it does hereby waive notice of such change, extension of time, alteration or addition to the terms of the Contract or to the Work or to the Specifications thereunder.

No final settlement between the Owner and the Contractor shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied, and it is expressly provided that if any legal action shall be filed upon this bond, venue shall lie in Harris County, Texas.

Simultaneously with the execution of this Payment Bond, the parties hereto have executed a Performance Bond, reference to which is made for all purposes. Nothing in this Payment Bond shall in any way invalidate or nullify the obligations of the parties as set forth in said Performance Bond.

IN TESTIMONY WHEREOF, the parties hereto have executed this instrument on this _____ day of _____, 20 ____.

(Authorized Signature of Principal)

(Title)

APPROVED AS TO FORM:

ATTEST:

Owner: Tomball Independent School District

(Secretary of Principal's Corporation)

Attorney Representing Owner

(Authorized Signature of Surety)

(Title)

END OF SECTION

Section CD
Right of Audit - Examination of Records

- .1 Records for all contracts, specifically including but not limited to lump sum contracts (i.e. fixed price or stipulated sum contracts), unit price, cost plus or time & material contracts with or without a guaranteed maximum (or not-to-exceed amounts) shall upon reasonable notice be open to inspection and subject to audit, scanning, and/or reproduction during normal business working hours. Such audits may be performed by any Owner's representative, or any outside representative engaged by Owner for the purpose of examining such records. The Owner or its designee may conduct such audits or inspections throughout the term of this contract and for a period of three years after final payment or longer if required by law. Owner's representatives may (without limitation) conduct verifications such as counting employees at the Construction Site, witnessing the distribution of payroll, verifying information and amounts through interviews and written confirmations with Contractor employees, field and agency labor, subcontractors, and vendors.
- .2 Contractor's "records" as referred to in this Exhibit shall include any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may in Owner's judgment have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document. Such records shall include (hard copy, as well as computer readable data if it can be made available), written policies and procedures; time sheets; payroll registers; payroll records; cancelled payroll checks; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, negotiation notes, etc.); original bid estimates; estimating work sheets; correspondence; change order files (including documentation covering negotiated settlements); backcharge logs and supporting documentation; invoices and related payment documentation; general ledger, information detailing cash and trade discounts earned, insurance rebates and dividends; and any other contractor records which may have a bearing on matters of interest to the Owner in connection with the contractor's dealings with the Owner (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of any or all of the following:
 - (a) Compliance with contract requirements for deliverables
 - (b) Compliance with approved plans and specifications
 - (c) Compliance with Owner's business ethics expectations
 - (d) Compliance with contract provisions regarding the pricing of change orders
 - (e) Accuracy of contractor representations regarding the pricing of invoices
 - (f) Accuracy of contractor representations related to claims submitted by the contractor or any of his payees.
- .3 Contractor shall require all payees (examples of payees include subcontractors, material suppliers, insurance carriers, etc.) to comply with the provisions of this article by including the requirements hereof in a written contract agreement between Contractor and payee. Contractor will ensure that all payees (including those entering into lump sum contracts) have the same right to audit provisions contained in this contract.
- .4 Owner's authorized representative(s) shall have reasonable access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this contract and shall be provided adequate and appropriate workspace, in order to conduct audits in compliance with this article.
- .5 If an audit inspection or examination in accordance with this article, discloses overpricing or overcharges to the Owner (of any nature) by the Contractor and/or the Contractor's Subcontractors in excess of \$100,000 in addition to making adjustments for the overcharges, the reasonable actual cost of the Owner's audit shall be reimbursed to the Owner by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records shall be made within a reasonable amount of time (not to exceed 90 days) from presentation of Owner's findings to Contractor.

This document has important legal consequences; consultation with your attorney is encouraged with respect to the incorporation of these contract concepts as part of your standard construction contract documents.

Section CD

Right of Audit – Records to Be Provided to Owner’s Representatives Upon Request

In addition, to the normal paperwork documentation the Contractor typically furnishes to the Owner, in order to facilitate efficient use of Owner resources when reviewing and/or auditing the Contractor’s billings and related reimbursable cost records, the Contractor agrees to furnish (upon request) the following types of information in the specified computer (PC) readable file format(s):

Type of Record	PC Readable File Format
Monthly Job Cost Detail	.pdf and Excel
Detailed job Cost History To Date	.pdf and Excel
Monthly Labor Distribution detail (if not already separately detailed in the Job Cost Detail)	.pdf and Excel
Total Job to date Labor Distrubution detail (if not already included in the detailed Job Cost History to date)	.pdf and Excel
Employee Timesheets documenting time worked by all individuals who charge reimbursable time to the project	.pdf
Daily Foreman Reports listing names and hours and tasks of personnel who worked on the project	.pdf
Daily Superintendent Reports	.pdf
Detailed Subcontract Status Reports (showing original subcontract value, approved subcontract change orders, subcontractor invoices, payment to subcontractors, etc.	.pdf and Excel
Copies of Executed Subcontracts with all Subcontractors	.pdf
Copies of all executed change orders issued to Subcontractors	.pdf
Copies of all documentation supporting all reimbursable job costs (subcontractor payment applications, vendor invoices, internal cost charges, etc.)	.pdf

This document has important legal consequences; consultation with your attorney is encouraged with respect to the incorporation of these contract concepts as part of your standard construction contract documents.

SECTION 01 10 00

SUMMARY OF WORK

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION *Specifier: Coordinate this paragraph with your project requirements.*

IF project is CSP – use this A.

- A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

IF project is CM@R – replace A with the following:

Refer to Section 01 25 00 – Request for Substitution Procedures.

IF project is CSP – delete this B.

IF project is CM@R - Find out if proposal instructions are provided or NOT provided.

- B. Refer to the CM@R Proposal Instructions. (Issued under separate cover.)

IF project is NOT in "Hurricane" zone – delete this C.

- C. This project is in the TWIA Zone: Inland I and building envelope components shall meet the requirements for certification / approval of Texas Department of Insurance. (TDI.)

Tailor to your project specific information.

- D. Scope of Work: The Project consists of the demolition of the existing elementary school buildings and associated site improvements; and construction of a new elementary school and related site facilities.

1.2 PROJECT INFORMATION

Tailor to your project specific information

- A. The Project, of which the work of this Contract is a part, is a New Cloverleaf Elementary School for Galena Park Independent School District.

- B. Location: The site is approximately 6.5 acres and is located at 1035 Frankie Street, Houston, Texas 77015.

- C. The Project consists of the complete demolition of the existing, multi-building Cloverleaf Elementary School and associated site improvements.

01 Demolition shall include abatement of hazardous materials.

02 Demolition shall include removal of all surface and subsurface existing improvements; except for the following:

a. Existing sanitary lift station.

b. Foundation structures below 72" from existing finish floor elevations.

- D. New work shall include construction of a new 2-story elementary school and associated site work as indicated on the Drawings and described in the Project Manual.

01 Building Area: approximately 114,456 SF.

- E. The project is under jurisdiction of Harris County, Texas.

PART 2 - PRODUCTS

2.1 PROJECT SCOPE DESCRIPTION

Tailor to your project specific information

A. Demolition Work Includes:

- 01 Abatement of hazardous materials from existing building(s).
- 02 Complete removal of all existing buildings, including underground improvements, unless noted otherwise on the Drawings or described in the Project Manual.
- 03 Complete demolition of all concrete paving, flatwork and similar type work.
- 04 Complete demolition of all site improvements unless specifically indicated to remain.
- 05 Removal of existing trees and vegetation unless specifically indicated to remain.

B. The New Work Includes:

- 01 Earthwork.
- 02 Concrete foundations and floor slabs.
- 03 Structural steel framing.
- 04 Metal roof decking.
- 05 Built-up modified bitumen roofing.
- 06 CMU masonry and light gauge steel framing exterior walls.
- 07 Masonry and stone veneer.
- 08 Plaster.
- 09 Hollow metal doors and frames.
- 10 Aluminum and glass doors and frames.
- 11 Solid core plastic laminate doors.
- 12 Door hardware and access control system / devices.
- 13 Interior and exterior glazing.
- 14 CMU and drywall interior partitions.
- 15 Suspended acoustical and gypsum board ceilings.
- 16 Interior finishes.
- 17 Specialties and equipment.
- 18 Food service equipment and fixtures.

C. New Sitework Includes:

- 01 Rough and final grading.
- 02 Imported select fill.
- 03 Concrete paving and sidewalks.
- 04 Underground storm, water and sanitary utilities.
- 05 Fencing.
- 06 Playground equipment.
- 07 Sports equipment.
- 08 Landscaping and irrigation system.
- 09 Aluminum walkway covers.
- 10 Marquee sign.
- 11 Site furnishings.

D. The MEP Work Includes:

- 01 HVAC systems.
- 02 New electrical service.
- 03 Plumbing.
- 04 Electrical power and lighting fixtures.

- 05 Communication systems.
- 06 Data infrastructure and wiring.
- 07 Fire alarm and security systems.

PART 3 - EXECUTION

3.1 SCHEDULE

- A. Project Commencement: On-site work may commence on **Tuesday, 12 June 2018**.
- B. Substantial Completion Time: The Owner has a critical need for the entire project to be substantially completed not later than **15 July 2019**.
 - 01 For the purposes of determining Proposer's Base Proposal amount, the above date shall be a targeted Substantial Completion Date; however, the Contract Time incorporated into the Owner-Contractor Agreement shall be based on Proposer's stated calendar days.
 - 02 For the purposes of determining Proposer's Alternate Proposal amount for a guaranteed Substantial Completion Date, the above date shall be a guaranteed Substantial Completion Date.
- C. Proposer's submission of a Competitive Sealed Proposal for this Project shall be based on adhering to the above commencement and completion dates.
 - 01 The Proposer's Contract amount shall include costs for all materials, equipment and labors required to achieve substantial completion by the designated date.
- D. Refer to Section CA - General Conditions and Section CB – Supplementary Conditions related to liquidated damages for failure to substantially complete the project on or before the date stipulated above.

END OF SECTION

SECTION 01 22 00

UNIT PRICES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Contractor shall state, in the spaces provided in the Proposal Form, unit prices for the Work described below.
 - 02 The same unit price for each item shall be used for both adding or deleting the described work if / as directed by the Architect during the progress of the Work.
 - 03 Costs declared for Unit Prices shall be the gross amount used for adjustment, based on the actual quantity of units directed to be adjusted.

PART 2 – DESCRIPTION OF UNIT PRICES

2.1 GENERAL

- A. For the Work described, unit pricing shall be used to determine the additional cost or credit to the Contract amount, or added to or deducted from the Owner's Contingency for changes in the Scope of Work made during the progress of the Work as directed by the Architect.
- B. The same price shall be used for adding or deducting from the Scope of Work. No Exceptions.
- C. The following unit prices shall be included on the proposal form and shall be included in the Owner - Contractor Agreement.

2.2 UNIT PRICES – SITE CONCRETE

- A. Provide unit pricing for the following site concrete work, including subgrade prep:
 - 01 Add / Delete 60" Wide Sidewalks _____ Lin. Foot (LF)
 - 02 Add / Delete Non-Traffic Concrete Flatwork _____ Sq. Foot (SF)
 - 03 Add / Delete Medium Duty (5") Concrete Paving _____ Sq. Foot (SF)
 - 04 Add / Delete Heavy Duty (7") Concrete Paving _____ Sq. Foot (SF)
 - 05 Add / Delete 6" Concrete Curb _____ Lin. Foot (LF)

2.3 UNIT PRICES – ELECTRICAL

- A. Provide unit pricing for the following electrical work:
 - 01 Add / Delete 120V duplex receptacle on nearest capable circuit _____ Each (EA)
 - 02 Add / Delete 120V duplex receptacle on dedicated _____

	circuit, including 20 amp circuit breaker	_____	Each (EA)
03	Add / Delete 220V receptacle on dedicated circuit including 20 amp circuit breaker	_____	Each (EA)
04	Add / Delete two-way light switch	_____	Each (EA)
05	Add / Delete three-way light switch	_____	Each (EA)

2.4 UNIT PRICES – TECHNOLOGY

A.	Provide unit pricing for the following technology work:		
01	Add / Delete a single data port wired to nearest IDF / MDF room	_____	Each (EA)
02	Add / Delete double data port wired to nearest IDF / MDF room	_____	Each (EA)
03	Add / Delete triple data port wired to nearest IDF / MDF room	_____	Each (EA)
04	Add / Delete j-box with 1-1/4" conduit stubbed Up wall to above ceiling	_____	Each (EA)

2.5 UNIT PRICES – DOORS AND FRAMES

A.	Provide unit pricing for the following door and frame work:		
01	Add / Delete interior 3070 SCPL, full flush door prepped for hardware	_____	Each (EA)
02	Add / Delete interior 3070 HM full flush door and HM frame, including painting	_____	Each (EA)
	Add / Delete interior 3070 aluminum door frame	_____	Each (EA)
03	Add / Delete exterior 31070 HM full flush door and HM frame, including painting	_____	Each (EA)
04	Add / Delete Nominal 8" x 31" door lite	_____	Each (EA)

END OF SECTION

SECTION 01 23 00

ALTERNATES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 The Contract Documents contain certain scopes of Work to be identified and priced separately by the Contractor.
 - 02 Alternate proposals are not included in the Contractors Base Proposal amount.
 - 03 Alternate proposals may be additive or deductive as determined by the Contractor.
 - 04 Acceptance or rejection of each Alternate shall be at the Owner's sole discretion.

1.2 ALTERNATE PRICES

- A. Contractor shall state, in the spaces provided in the Proposal Form, alternate prices for the work described in the Alternate.
 - 01 Proposer's pricing for Alternates shall be the net change to the Base Proposal amount to include the cost of all supporting elements required to implement the described Alternate Scope of Work.
 - 02 Work for all Alternates shall be in strict accordance with the Specification and applicable work as indicated on the Drawings.
- B. Unless otherwise indicated, Scope of Work for each Alternate shall include material and labor, general conditions, and all other costs, as applicable, associated with completing the Work described.
- C. Alternates are not listed in the order of priority.
- D. Acceptance of Alternates and inclusion in the Owner-Contractor Agreement shall be at the sole discretion of the Owner.
 - 01 Proposed pricing of Alternate Proposals shall be such that no matter what combination of Base Proposal and Alternates are accepted, the corresponding Contract amount shall be the total sum required to provide the full and defined Scope of Work.

1.3 MEAL ROOF COATIG SYSTEM

- A. Pressure wash and Prepare existing Metal Panel Roof and Apply Primer.
- B. Seal seams and flashing with mastic.
- C. Install base coat and topcoat white high tensile coating for weatherability and mildew

resistance.

- D. Roof Coating systems are fully described in the Drawings and Specifications; and shall be the basis for pricing the alternate proposals.
- E. The Owner-Contractor Agreement amount shall include acceptance of this Alternate.

1.4 EXTERIOR WINDOW SYSTEMS

- A. Provide exterior double pane insulated windows in lieu of exterior metal panel wall system at locations indicated on the Drawings. Horizontal louver blinds are part of this alternate and will not be installed if the alternate is not accepted.
- B. The Owner-Contractor Agreement amount shall include acceptance of this Alternate.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF ALTERNATE PROPOSALS

- A. **ALTERNATE NO. 1 – Metal Roof Coating System**
This Alternate shall establish the amount to be added/deducted from the Base Proposal for the Contractor to provide and install a metal roof coating system.
- B. **ALTERNATE NO. 2 – Exterior Window Systems and Horizontal Louver Blinds.**
This Alternate shall establish the amount to be added / deducted from the Base Proposal for the Contractor to provide and install exterior double pane insulated windows where indicated on the Construction Documents

END OF SECTION

SECTION 01 25 00

REQUEST FOR SUBSTITUTION PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Each Specification Section includes products, materials and / or equipment incorporated into the Scope of Work as the “Basis of Design”, as well as listed other acceptable manufacturers / providers.
 - 02 Substitutions Prior To Award of Contract: Procedures and required documentation for a request for substitution of products, materials and / or equipment from those required by the Contract Documents.
 - 03 Substitutions After Award of Contract: Procedures and required documentation for a request for substitution of products, materials and / or equipment from those required by the Contract Documents.
 - a. The Scope of Work is based products, materials and equipment used for the Basis of Design which the Owner has approved.
 - b. Except for other provisions included in the Contract, in order to receive due consideration, requests for substitution after award of Contract should be accompanied with incentive – financial or schedule – to the Owner for accepting the substitution.
 - 04 No consideration will be given to requests for substitution for products, materials and / or equipment that is described as “no substitutions”.

1.1 SUBMITTALS

- C. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- D. In order for a request for substitution to be considered, submit the following to the Architect as a single, concise complete package.
 - 01 Incomplete, vague or ambiguous packages will not be considered and result in the request being denied.
- E. Substitution Request Form (attached at end of this Section)
 - 01 Two forms are attached at the end of this Specification Section:
 - a. Substitution Request Form – Pre-Contract Award
 - b. Substitution Request form – Post-Contract Award
 - 02 Submit the appropriate form, fully executed.
- F. Specification Section: Return the complete Specification Section with the following:
 - 01 Each and every paragraph, statement and description clearly initialed to signify the proposed substitution will meet or exceed the specified requirement.
 - 02 For any of the proposed substitution deviation of any requirement or provision of the Specification, clearly describe what is proposed if the substitution is accepted.

- G. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 01 Pertinent product data must be clearly indicated; and conversely, product data that is not applicable must be clearly marked out or indicated as not applicable.
 - 02 Architect's review shall not include interpretation of vague or ambiguous product data.
- H. Shop Drawings:
 - 01 Provide Shop Drawings and / or details that depict the proposed substitution as it would be incorporated into the Work.
 - 02 Details submitted for review shall be specific to the Work of this Contract and shall accurately depict adjacent and interfacing products / materials within the assembly(s) indicated on the Drawings.
 - 03 Generic details that do not accurately depict the Project's adjacent or interfacing work shall not be accepted; and result in disapproval of the requested substitution.
- I. Color / Finish Samples: For substitution requests relating to finished exterior or interior products, submit the following:
 - 01 Provide two (2) samples of each proposed finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.
 - 04 For finishes that have been specifically indicated in the Contract Documents, submit proposed finish samples that match or closely approximate the specified material.
 - 05 For brick veneer provide each type of proposed brick to be provided in quantities sufficient to show range of color where applicable.

PART 2 – SUBSTITUTION SUBMISSION REQUIREMENTS

2.1 REQUEST FOR SUBSTITUTION – PRE-CONTRACT AWARD

- A. All requests for substitution packages submitted Pre-Contract Award (during bidding / proposal phase) must be submitted to the Architect a minimum of ten (10) days prior to receipt of bids / proposals.
 - 01 Requests for substitution packages submitted less than ten (10) days prior to receipt of bids / proposals shall not be reviewed.
- B. It is the sole responsibility of the submitter to confirm the submission is complete and accurate.
 - 01 Incomplete or inaccurate substitution packages may be rejected without notification to the submitter.
 - 02 The Architect shall have sole discretion to inform or not inform the submitter of any information missing from the substitution package.
- C. In order for a substitution package to be considered, the following are required:
 - 01 Substitution request must be fully documented and properly submitted within the specified time.
 - 02 Substitutions must be completely compatible and properly interface with other portions of the Work.
 - 03 Substitution must provide specified warranty.

- D. All substitutions approved by the Architect prior to submission of bids / proposals shall be incorporated into the Contract Documents by Addendum.
- E. Substitutions not added to the Contract Documents by Addendum may be submitted by a General Contractor / Proposer as a supplemental qualification to his Base Bid / Base Proposal.
 - 01 Under this condition, the Base Bid / Base Proposal submitted by the General Contractor / Proposer must be based on the Contract Documents.
 - 02 The General Contractor / Proposer may submit a clearly stated qualification to the Base Bid / Proposal relative to the substitution for consideration.
 - 03 The stated qualification must include a statement of financial or project schedule incentive to the Owner in order for the qualified substitution to be considered.
 - 04 The stated qualification must include what impact, if any the substitution has on adjacent or interfacing work.
 - 05 The stated qualification must include a written statement from the General Contractor / Proposer that he has fully investigated the proposed substitution and will accept responsibility of the substitution for inclusion in the Project.

2.2 REQUEST FOR SUBSTITUTION – POST-CONTRACT AWARD

- A. If allowed by the Contract or Contract Documents, requests for substitution post-Contract Award may be considered by the Architect under the following conditions:
 - 01 The Basis of Design product, material or equipment is no longer available.
 - 02 The product, material or equipment is no longer available from a listed acceptable manufacturer.
 - 03 The proposed substitution shall result in a financial or schedule incentive to the Owner should it be accepted.
- B. Unless otherwise agreed to by the Architect, the Contractor shall allow a minimum of twenty-one (21) days for A/E review of requests for substitution Post-Contract Award.
- C. It is the sole responsibility of the Contractor and submitter to confirm the submission package is complete and accurate.
 - 01 Incomplete or inaccurate request for substitution packages may be rejected without a completed review by the Architect.
- D. In order for a substitution package to be considered, the following are required:
 - 01 Substitution request must be fully documented and properly submitted within the specified time.
 - 02 Substitutions must be completely compatible and properly interface with other portions of the Work.
 - 03 The substitution package must include documentation of any resultant impact to adjacent or interfacing work.
- E. All substitutions approved by the Architect Post-Contract Award shall be incorporated into the Contract Documents by appropriate documentation (i.e. CPR, AEA, ASI or similar) as a matter of record.

PART 3 – REQUEST FOR SUBSTITUTION FORMS

REQUEST FOR SUBSTITUTION FORM – PRE-CONTRACT AWARD

Project Name: Tomball High School CTE and Misc. Renovations
Texas Arcadis, Inc. Project No.: 202311

We hereby submit for your consideration this Request for Substitution for the following product, material and / or equipment included in the Contract Documents for the above Project:

Specification Section: _____ Specific Paragraph (as applicable): _____

Specification Name: _____

Specified Manufacturer: _____ Model No.: _____

Proposed Manufacturer: _____ Model No.: _____

All attached supporting documentation is confirmed to be complete and accurate; and in accordance with the submittal requirements of this Section.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be readily available for the proposed substitution.

SUBMITTED BY:

Signature

Contact Phone Number

Printed Name and Title

Contact Email Address

Company Name

Company Address

City, State and Zip Code

REQUEST FOR SUBSTITUTION FORM – POST-CONTRACT AWARD

Project Name: Tomball High School CTE and Misc. Renovations
Texas Arcadis, Inc. Project No.: 202311

We hereby submit for your consideration this Request for Substitution for the following product, material and / or equipment included in the Contract Documents for the above Project:

Specification Section: _____ Specific Paragraph (as applicable): _____

Specification Name: _____

Specified Manufacturer: _____ Model No.: _____

Proposed Manufacturer: _____ Model No.: _____

Reason for Substitution Request: _____

Associated Owner Incentive: _____

All attached supporting documentation is confirmed to be complete and accurate; and in accordance with the submittal requirements of this Section.

The undersigned certifies that the following paragraphs, unless modified by attachments, are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse effect on other trades, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be readily available for the proposed substitution.

SUBMITTED BY:

Signature

Contact Phone Number

Printed Name and Title

Contact Email Address

Company Name

Company Address

City, State and Zip Code

CONTRACTOR:

Signature

Printed Name and Title

END OF SECTION

SECTION 01 26 00

CONTRACT ADMINISTRATION DOCUMENT MANAGEMENT

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- . Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- A. Scope of Work:
This section describes procedures to be followed for processing the following documents:
 - 01 RFI – Request for Information.
 - 02 ASI – Architect's Supplemental Instructions.
 - 03 CPR – Change Proposal Request.
 - 04 PCR – Potential Change Request.
 - 05 AEA – Allowance Expenditure Authorization.
 - 06 CCD – Construction Change Directive.
- C. Related Sections:
 - 01 Section 01 21 00 – Allowances
 - 02 Section 01 25 00 - Request for Substitution Procedures
 - 03 Section 01 29 76 – Progress Payment Procedures
 - 04 Section 01 33 00 – Submittal Procedures
 - 05 Section 01 77 00 – Close-Out Procedures

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. All documents included in the scope of this Section shall be processed through the Owner's document management software. (Project Mates)
- C. Documents originating from the Contractor may be distributed directly to Architect's Consultants, as applicable, provided designated Architect team members are copied or included in the transmission.
- D. Documents originating from the Architect shall be distributed directly to Contractor's designated team members.
- E. Inclusion of Owner with respect to transmissions shall be determined at the pre-construction conference prior to commencement of Work.
- F. The Contractor shall keep up-to-date logs of the documents included in the scope of this Section.
 - 01 Logs shall include document type, number, subject, submission date, requested response date, actual response date, cost impact, contract time impact, and status as applicable (i.e. pending, approved, not approved, voided)
 - 02 Contractor shall provide copies of logs to attendees at Owner-Architect-

Contractor (OAC) regular meetings.

PART 2 - DOCUMENTATION

2.1 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information, clarification or interpretation of the Contract Documents, Contractor shall initially correspond with the Architect's field representative to resolve the issue.
 - 01 If resolution is not determined by the Architect's field representative, prepare, and submit an RFI in the form specified using the Architect's electronic project document management software.
 - 02 Issues resolved at the Architect's Field Representative level which results in a Contractual Minor Change or Clarification shall be documented by the Architect as appropriate to the change.
- B. RFIs must originate from the Contractor. Architect will not accept RFIs submitted by subcontractors or other entities controlled by Contractor.
 - 01 The Contractor shall endeavor to resolve subcontractor submitted RFI's directly with the subcontractor prior to submitting an RFI to the Architect.
- C. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's Work or Work of subcontractors.
- D. Contractor uses the RFI to request direction and / or clarification resulting from, but not limited to the following:
 - 01 Conflicts, omissions, ambiguities, or discrepancies within the Contract Documents.
 - 02 Conflicts between the Contract Documents and any provision of code or regulation applicable to the performance of the Work.
 - 03 Conflicts between the Contract Documents and any standard Specification or instruction of a manufacturer.
 - 04 Conflicts with differing existing conditions.
- E. Content of RFI:
 - 01 Drawing sheet number reference, building area, room number and / or other specific description of the location of the issue; as appropriate.
 - 02 Specification Section number, page number, paragraph number and item number of the location of the issue; as appropriate.
 - 03 A detailed description of item needing information, clarification or interpretation.
 - 04 Attachments: Include sketches, descriptions, measurements, photos, product data, Shop Drawings, Coordination Drawings, and other information necessary to fully describe items needing interpretation.
 - 05 Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
 - 06 Field dimensions and / or conditions; as appropriate.
 - 07 Photographs of issue in question; as appropriate.
 - 08 Contractor's proposed / recommended resolution.
 - 09 Statement identifying one of the following:
 - a. No Cost Impact
 - b. Cost Impact Unknown
 - c. Cost Impact Anticipated
 - 10 Statement identifying one of the following:
 - a. No Contract Time Impact
 - b. Contract Time Impact Unknown

c. Contract Time Impact Anticipated

- F. Architect's Actions:
- 01 Architect will review each RFI, determine action required, and respond.
 - 02 Allow up to five (5) working days for Architect's response for each RFI. If the Contractor believes a faster response time is necessary in order to maintain schedule, it must be clearly indicated on the RFI.
 - 03 The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
 - 04 Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 - 05 If Contractor believes the RFI response warrants change in the Contract Sum or the Contract Time, Contractor must notify Architect in writing within three (3) working days of receipt of the RFI response.
 - a. Failure of notification within the specified time frame shall be Contractor's concurrence that implementation of the Architect's response does not result in a change to Contract Sum or Contract Time.
 - 06 Architect's action on RFIs that may result in a change to the Contract Sum or the Contract Time may be eligible for Contractor to submit Potential Change Request to the Architect for consideration.

2.2 ARCHITECT'S SUPPLEMENTAL INSTRUCTION (ASI)

- A. General: ASI's are instruments initiated by the Architect and submitted to the Contractor regarding clarifications, interpretations and / or minor changes in the Work that are consistent with the Contract Documents and do not affect the Contract Sum or the Contract Time.
- 01 ASI's may also be used to contractually document an issue that was initially resolved on site between the Contractor's superintendent and the Architect's field representative.
 - 02 ASI's shall be initiated and processed using the Architect's electronic project document management software.
- B. Content of ASI:
- 01 Drawing sheet number reference, building area, room number and / or other specific description of the location of the issue; as appropriate.
 - 02 Specification Section number, page number, paragraph number and item number of the location of the issue; as appropriate.
 - 03 A detailed description of item needing information, clarification or interpretation.
 - 04 Attachments: sketches, descriptions, measurements, photos, product data, Shop Drawings, Coordination Drawings, and other information necessary to fully describe items needing interpretation.
 - 05 Dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. Contractor's Action:
- 01 The Contractor shall expeditiously distribute the ASI directive to all affected parties / subcontractors as required for the ASI directive to be implemented into

- the Work.
 - 02 Failure by the Contractor to expeditiously distribute the ASI directive which subsequently results in a claim for additional cost shall preclude any consideration of the claim.
 - 03 The Contractor shall coordinate all affected trades and make all necessary adjustments to project scope and schedule required to implement the ASI change at the appropriate time.
 - 04 If the Contractor fails to properly implement the ASI change at the appropriate time, all subsequent costs required to achieve proper implementation of the ASI change shall be solely at the Contractor's expense.
 - 05 The Contractor shall document the ASI directive on the Record Drawings kept at the site.
- D. If Contractor believes the ASI directive(s) warrants change in the Contract Sum or the Contract Time, Contractor must notify Architect in writing within three (3) working days of receipt of the ASI.
- 01 Failure of notification within the specified time frame shall be Contractor's concurrence that implementation of the Architect's ASI directive(s) does not result in a change to Contract Sum or Contract Time.
 - 02 Upon notification, one of the following shall be implemented, as agreed upon by Architect, Owner and Contractor:
 - a. The Contractor shall issue a Potential Change Request (PCR) stating the proposed additional cost and / or change in contract time; or,
 - b. The Architect shall convert the ASI to a Change Proposal Request (CPR) to allow the Contractor to respond; or,
 - c. The Architect shall convert the ASI to a Construction Change Directive (CCD) if required for timely implementation.

2.3 CHANGE PROPOSAL REQUEST (CPR)

- A. General: CPR's are instruments initiated by the Architect and submitted to the Contractor regarding changes in the Contract Documents that may result in a change in the Contract Sum or the Contract Time.
- 01 CPR's may be issued for the following:
 - a. Addition, deletion or modification of the scope of Work.
 - b. Implementation of Owner initiated changes.
 - c. Document legitimate notifications from Contractor regarding potential change in the Contract Sum or Contract Time due to Architect's response to an RFI or Architect's issuance of an ASI.
 - 02 CPR's shall be initiated and processed using the Architect's electronic project document management software.
- B. Content of CPR:
- 01 Drawing sheet number reference, building area, room number and / or other specific description of the location of the CPR subject; as appropriate.
 - 02 Specification Section number, page number, paragraph number and item number of the location of the CPR subject; as appropriate.
 - 03 A detailed description or directive of the revision of the Contract Documents.
 - 04 Attachments: sketches, descriptions, measurements, photos, product data, Shop Drawings, Coordination Drawings, and other supporting documentation necessary to fully describe the change in the scope of the Work.
 - 05 The CPR shall indicate how the CPR will be funded by the Owner.
- C. Contractor's Action:
- 01 The Contractor shall expeditiously distribute the CPR to all affected parties / subcontractors as required for pricing of each affected trade.

- 02 Failure by the Contractor to expeditiously distribute the ASI directive which subsequently results is a claim for additional cost shall preclude any consideration of the claim.
- 03 For all approved CPR's, the Contractor shall document the CPR on the Record Drawings kept at the site.
- D. Contractor's CPR Response:
 - 01 The Contractor shall endeavor to provide CPR responses within (ten) 10 working days from receipt of the CPR.
 - 02 The Contractor shall provide detailed cost and / or credit documentation for all CPR's.
 - 03 Provide a cover letter stating the overall cost / credit impact and all adjustments to Contract Time.
 - 04 Responses that include a change in Contract Time must be accompanied by a detailed description of how the scope of Work in the CPR affects the critical path of the Contractor's schedule. Proposed changes in Contract Time must affect the critical path in order to be considered.
 - 05 Cost changes that are included in the Contract as unit prices must use the unit price amounts.
 - 06 Cost changes shall reflect the allowable mark-ups in accordance with the Conditions of the Contract.
 - 07 In addition to the cover letter, the CPR response must include the following:
 - a. Detailed spreadsheet, including materials and labor, for all work proposed to be self-performed by the Contractor.
 - b. A detailed breakdown, including materials and labor, from each subcontractor responding to the CPR.
 - 08 Prior to submission of the CPR response to the Architect for review, the Contractor shall thoroughly review all subcontractor responses and verify the following:
 - a. All interpretations of scope are accurate.
 - b. Unit pricing has been used where applicable in accordance with the Contract.
 - c. Material take-offs are accurate.
 - d. Labor units / hours are fairly assigned.
 - e. Subcontractor mark-ups are in accordance with the Conditions of the Contract.
 - f. Taxes have not been added where prohibited for tax-exempt projects.
 - 09 For CPR's to be funded by an allowance, no mark-up by the Contractor is permitted. For CPR's to be funded by Change Order, the Contractor's mark-up shall be in accordance with the Conditions of the Contract.
- E. Architect's Review of CPR Response:
 - 01 Upon receipt of the Contractor's CPR response, the Architect shall review all documentation included in the response.
 - 02 Questions or request for additional information regarding the response shall be directed to the Contractor as needed. The Contractor shall promptly respond to Architect's questions or request for additional information.
 - 03 Upon final review, the Architect shall make recommendation to the Owner for acceptance or rejection of the CPR and related scope of work.
 - a. Where the Contractor's response includes both a Contract Sum and Contract Time adjustment, the Architect may recommend acceptance of the cost and rejection of the time where the requested time extension does not affect the critical path of the project.
 - 04 If approved / accepted by the Owner, the CPR shall be included on a future Allowance expenditure Authorization (AEA) or Change Order.

2.4 ALLOWANCE EXPENDITURE AUTHORIZATION (AEA)

- A. General: AEA's are instruments initiated by the Architect and submitted to the Contractor and Owner for approval to fund CPR changes in the Contract Sum and / or changes in the Contract Time where the funding source is an Allowance included in the Contract.
 - 01 AEA's shall be initiated and processed using the Architect's electronic project document management software.
- B. Approved expenditures to be funded by an allowance shall be documented by an AEA specific and exclusive to that particular allowance.
- C. AEA's may be used to transfer funds from one allowance to another allowance.
- D. Each AEA shall include attachment of all CPR expenditures or CPR credits included in the AEA.
 - 01 A summary of expenditures for the respective allowance shall be included in each AEA.
- E. The AEA shall also include documentation of any adjustment in Contract Time which is being approved.
- F. At the Owner's discretion and direction, the Contractor may proceed with approved Work included in a CPR prior to final production and execution of an AEA. Such direction to proceed with Work shall be made in writing to the Contractor for record.
- G. The Contractor shall document allowance expenditures on progress applications for payment in accordance with **Section 01 29 76 – Progress Payment Procedures**.

2.5 CONSTRUCTION CHANGE DIRECTIVE (CCD)

- A. General: CCD's are instruments initiated by the Architect and submitted to the Contractor and Owner for approval to direct the Contractor to proceed with Work prior to Owner's final acceptance of Contractor's proposed changes in the Contract Sum and / or changes in the Contract Time.
 - 01 CCD's are primarily issued to eliminate impact to the Contractor's schedule for the directed Work for the following reasons:
 - a. Final agreement on cost has not been achieved.
 - b. Final agreement on time extensions has not been achieved.
 - c. Final Owner approval of the change document has not been achieved (i.e. school board action required at a regular board meeting).
 - 02 CCD's shall be signed by all parties – Owner, Architect and Contractor – upon issuance.
 - 03 CCD's shall be initiated and processed using the Architect's electronic project document management software.
- B. Contractor's Action:
 - 01 Upon receipt of a CCD, the Contractor shall expeditiously distribute the CCD to all affected parties / subcontractors as required for implementation of the directed Work.
 - 02 Failure by the Contractor to expeditiously distribute the CCD directive which subsequently results is a claim for additional cost shall preclude any consideration of the claim.

- C. Contractor's Final Pricing for CCDs:
- 01 The CCD shall include information of how final costs shall be determined.
 - 02 The CCD shall include information regarding consideration for any allowance of extensions of Contract Time.
 - 03 If final cost is to be determined on a time and material basis, Contractor shall maintain and furnish detailed records of all time, employee activities and material expenses associated with the CCD.
 - a. Upon agreement by the Owner and Contractor, the CCD may include a "Not to Exceed" amount relative to a time and material cost basis.
 - 04 If a CCD is issued due to disagreement on the Contractor's proposed pricing of a CPR or PCR, the disputed pricing of the CPR or PCR response shall represent the Contractor's maximum cost to implement the CCD directed Work.
 - 05 If a CCD is issued due to disagreement on the Contractor's request for extension of time relative to a CPR or PCR, the disputed extension of time of the CPR or PCR response shall represent the Contractor's maximum extension of time to implement the CCD directed Work.
- D. Upon completion of the CCD directed Work, if the final Contractor's submitted cost and / or request for extension of time is not agreed upon by the Owner, the Contractor may pursue other claim remedies in accordance with the Contract.

END OF SECTION

SECTION 01 29 73

SCHEDULE OF VALUES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specified herein and in other provisions of the Contract Documents.
- C. Related Work:
 - 01 Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 02 Section 01 29 76 – Progress Payment Procedures
 - 03 Each Specification Section shall be used to determine requirements and breakdown of the schedule of values.

1.1 SUBMITTALS

- A. Schedule of Values - Draft: Prior to the first application for payment, and within thirty (30) calendar days after execution of the Owner-Contractor Agreement, submit a proposed schedule of values to the Architect, as outlined below, for review.
 - 01 The schedule of values is represented in Column C of the AIA G702/G703 – Application for Payment.
- B. Coordinate with the Architect and determine what additional breakdown, if any, is required to be submitted for final approval.
- C. Secure the Architect's approval of the schedule of values prior to submitting the first Application for Payment.
- D. Schedule of Values – Final: Upon approval by the Architect, the final schedule of values shall be submitted for review and acceptance.
 - 01 Once established, the schedule of values shall not be altered, except for the execution of a Change Order to the Contract.

1.2 QUALITY ASSURANCE

- A. Use required means to assure arithmetical accuracy of the sums described.
- B. When so requested by the Architect, provide copies of the subcontracts or other data acceptable to the Architect, substantiating the line item amounts in the schedule of values.

- C. At a minimum, the schedule of values shall be broken down into costs for each Specification Section as labor and materials.
 - 01 Where Specification Sections cover multiple Scopes of Work or products, the schedule of values shall reflect each scope / product separately.
- D. The Contractor is encouraged to make the schedule of values very detailed in order to facilitate review and approval of requested percentages complete on Pay Applications.
 - 01 Where breakdown is vague, or includes multiple / combined assemblies, stages, tasks, etc., Architect's review shall be conservative in favor of the Owner regarding approval of Pay Applications.

PART 2 - PRODUCTS

2.1 APPLICATION FOR PAYMENT SCHEDULE OF VALUES

- A. The schedule of values, once approved shall be transferred to Columns B and C of AIA G702/G703 – Application for Payment to be used for all progress payments.
- B. Once AIA G702/G703 – Application for Payment has been submitted for payment, individual line item amounts in Column C must remain unchanged throughout the progress of the Work.
- C. In the beginning stages of the construction, total amounts for entire Divisions may be used if complete breakdowns are not available; and shall be line item populated as soon as practical.
- D. No payments will be approved in Divisions that do not have a line item breakdown.
- E. Allowances shall be shown, and remain throughout construction, as a single line item on the Master Application for Payment in amount(s) as stipulated in the Contract Documents.
- F. For each Allowance, expenditures and accounting shall be included on a separate, attached spread sheet of the same format as the Master Application for Payment.
- G. The Master Application for Payment shall reflect only the summary of each Allowance; and shall not contain individual Allowance activity(s).

2.2 SCHEDULE OF VALUES - ALTERNATES

- A. For accepted Alternates which are “stand alone” Scopes of Work, separately indicate each Alternate with its own corresponding schedule of values.
- B. For accepted Alternates that are integrated into multiple trades performing the Work, adjust individual line item schedule of values to reflect the scope of the Alternate.
- C. Coordinate with the Architect as required.

2.3 SCHEDULE OF VALUES FOR ALLOWANCE EXPENDITURES

- A. Each Owner approved allowance in the Contract shall be stated as a single line item in the schedule of values.
 - 01 The scheduled value in Column C shall be the total of the Allowance and shall remain constant throughout the progress of the Work.

- B. In addition to the Master Application for Payment, for each Allowance, the Contractor shall develop a separate, supplemental spreadsheet in the same format as AIA G703 that shall track approved expenditures of the Allowance.
- C. Each approved Allowance expenditure item shall be listed separately with the authorized / scheduled value identified in Column "C" on the supplemental Allowance spreadsheet.
- D. Progress on each expenditure shall be tracked on the supplemental spreadsheet (i.e. previously billed, Work this period, overall completion percentage, etc.).
- E. The Master Application for Payment shall include ONLY summary totals from each Allowance supplemental spreadsheet for each Pay Application period.

2.4 SCHEDULE OF VALUES

- A. Schedule of values for Specification Division 2 through 33 shall be broken down for each separate section of work, and include multiple items / Scopes of Work covered where appropriate.
 - 01 Each item of Work shall be broken down by material and labor at a minimum.
 - 02 Where payment for Shop Drawings, submittals, Record Drawings and similar are expected to be billed separately, the items must be included as a standalone item on the schedule of values.
- B. In order for a subcontractor / trade to invoice for the following items, each item must be listed separately under the appropriate section of their respective work:
 - 01 Mobilization
 - 02 Overhead & supervision
 - 03 Submittals / Shop Drawings
 - 04 Coordination Drawings
 - 05 Operations and maintenance manuals
 - 06 Close-out documentation
- C. For projects that include work on multiple buildings, each building's Scope of Work shall be listed separately on the schedule of values.
- D. For larger projects, the schedule of values shall be broken down by building areas (i.e. A, B, C, D, etc.) and floor (1st, 2nd, etc.) as identified on the Drawings for the following Scopes of Work.
 - 01 Division 3 – Concrete
 - 02 Division 5 – Structural Steel
 - 03 Division 7 – Roofing
 - 04 Division 21 – Fire Protection
 - 05 Division 22 – Plumbing
 - 06 Division 23 – Mechanical
 - 07 Division 26 – Electrical
 - 08 Division 27 – Communications / IT

2.5 SCHEDULE OF VALUES BREAKDOWN

- A. Schedule of Values – The following shall represent the minimum breakdown of line items; and shall include material and labor for each item where applicable:

DIVISION 1 – GENERAL CONDITIONS

- 01 Building Permits
- 02 Bonds

- 03 Insurance
- 04 General Contractor's Fee
- 05 General Contractor's Overhead
- 06 Supervision
- 07 Mobilization
- 08 Temporary Facilities
- 09 Temporary Fencing
- 10 SWPPP
- 11 General Cleaning
- 12 Final Cleaning
- 13 Close-Out Documents
- 14 Operation and Maintenance Manuals
- 15 Record Drawings
- 16 MEP Coordination Drawings
- 17 Allowances (list each separately)
- 18 Alternates (list each separately as applicable)

DIVISION 2 – EXISTING CONDITIONS

- 01 Selective Demolition

DIVISION 3 – CONCRETE

- 01 Below Slab Vapor Membrane
- 02 Drilled Piers / Spread Footings
 - a. Formwork
 - b. Reinforcement
 - c. Concrete
 - d. Placement
- 03 Grade Beams
 - a. Formwork
 - b. Reinforcement
 - c. Concrete
 - d. Placement
- 04 Slab on Grade
 - a. Formwork
 - b. Reinforcement
 - c. Concrete
 - d. Placement

DIVISION 4 – MASONRY

- 01 Project Coordination Drawings
- 02 Masonry Restoration
- 03 Masonry Ties
- 04 Brick Veneer – Exterior
- 05 CMU
- 06 Masonry Cleaning
- 07 Water Repellant

DIVISION 5 – METALS

- 01 Steel Shop Drawings
- 02 Project Coordination Drawings
- 03 Structural Steel
- 04 Structural Steel Erection
- 05 Steel Joists
- 06 Light Gage Steel Framing
- 07 Metal fabrications
- 08 Pipe and Tube Railing

DIVISION 6 – WOOD AND PLASTICS

- 01 Rough Carpentry
- 02 Finish Carpentry

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

- 01 Elastomeric Waterproofing
- 02 Shower Stall Waterproofing
- 03 Building Insulation
- 04 Metal Roofing
- 05 Metal Wall Panels
- 06 Sheetmetal Flashing
- 07 Roof Accessories
- 08 Roof Hatches and Vents
- 09 Penetration Fire-stopping
- 10 Fireproofing
- 11 Joint Sealants

DIVISION 8 – DOORS AND WINDOWS

- 01 Hollow Metal Frames
- 02 Hollow Metal Doors
- 03 Aluminum Doors and Frames
- 04 Plastic Laminate-Faced Wood Doors
- 05 Access Doors and Frames
- 06 Overhead Coiling Doors
- 07 Finish Hardware
- 08 Glazed Systems – Framing
- 09 Glazed Systems – Glazing
- 10 Louvers and Vents

DIVISION 9 – FINISHES

- 01 Project Coordination Drawings
- 02 Gypsum Board Assemblies – Walls
 - a. Metal Framing
 - b. Gypsum Board
 - c. Taping and Floating
- 03 Metal Framing – Ceilings
 - a. Metal Framing
 - b. Gypsum Board
 - c. Taping and Floating
- 04 Ceramic Tile
- 05 Acoustical Ceilings
- 06 Slip Resistant Coatings
- 07 Concrete Floor Sealer
- 08 Resilient Tile Flooring
- 09 Carpet
- 10 Cementitious Wood Fiber Wall Panels
- 11 Sound Absorbing Wall Units
- 12 Painting

DIVISION 10 – SPECIALTIES

- 01 Miscellaneous Specialties
- 02 Marker Boards
- 03 Tack Boards
- 04 Display Cases
- 05 Exterior Signage

- 06 Interior Signage
- 07 Toilet Partitions
- 08 Wire Mesh Partitions
- 09 Demountable Partitions
- 10 Corner Guards
- 11 Bumper Guards / Chair Rail
- 12 Toilet and Bath Accessories
- 13 Fire Extinguishers and Cabinets
- 14 Metal Lockers
- 15 Wood Benches
- 16 Aluminum Walkway Covering
- 17 Steel Walkway Coverings

DIVISION 11 – EQUIPMENT

- 01 Residential Appliances
- 02 Food Service Equipment
- 03 Laboratory Equipment
- 04 Vocational Shop Equipment

DIVISION 12 – FURNISHINGS

- 01 Horizontal Blinds
- 02 Manufactured Plastic-Laminate-Clad Casework
- 03 Laboratory Casework
- 04 Performing Arts Casework
- 05 Entrance Floor Mats and Frames
- 06 Library Furniture
- 07 Upholstered Audience Seating
- 08 Telescoping Bleachers
- 09 Table and Chair Assemblies
- 10 Site Seating and Tables
- 11 Bicycle Racks

DIVISION 13 – SPECIAL CONSTRUCTION

- 01 Metal Building Systems
- 02 Wall Panels for Pre-Engineered Buildings
- 03 Roof Panels For Pre-Engineered Buildings

DIVISION 14 – CONVEYING SYSTEMS

DIVISION 21 – FIRE PROTECTION

- 01 Project Coordination Drawings
- 02 Fire Alarm Devices
- 03 Fire Alarm Wiring
- 04 Fire Sprinkler Equipment
- 05 Fire Sprinkler Piping
- 06 Fire Sprinkler Fixtures
- 07 Fire Sprinkler Trim-Out

DIVISION 22 - PLUMBING

- 01 Project Coordination Drawings
- 02 Under Slab Sanitary
- 03 Bentonite Dams At Trenches
- 04 Above Slab Sanitary
- 05 Above Slab Water
- 06 Plumbing Fixtures
- 07 Plumbing Trim-Out

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

- 01 Project Coordination Drawings
- 02 Rigid Ductwork
- 03 Flexible Ductwork
- 04 Grilles and Diffusers
- 05 Mechanical Trim Out
- 06 Air Handlers
- 07 Condensing Units

DIVISION 26 –ELECTRICAL

- 01 Project Coordination Drawings
- 02 Panelboards
- 03 Transformers
- 04 Site Underground Electrical
- 05 Site Lighting
- 06 Under Slab Electrical
- 07 Bentonite Dams At Trenches
- 08 Electrical Rough-in – Power
- 09 Electrical Rough-in – Lighting
- 10 Power Devices
- 11 Light Fixtures
- 12 Electrical Trim Out
- 13 Data and Technology
- 14 Communication System
- 15 Security System – Video
- 16 Security System - Intrusion
- 17 CATV System

DIVISION 31 – EARTHWORK

- 01 Site Clearing
- 02 Excavation, Fill and Earthwork
- 03 Site Drainage / Erosion Control
- 04 Bentonite Dams At Trenches
- 05 Rough Grading
- 06 Finish Grading
- 07 Storm Drainage
- 08 Site Water Utilities
- 09 Site Sanitary Sewer
- 10 Lime Stabilization

DIVISION 32 – EXTERIOR IMPROVEMENTS

- 01 Concrete Paving
- 02 Lime Stabilization
- 03 Curbs
- 04 Sidewalks / Miscellaneous Concrete Flatwork
- 05 Chain Link Fencing

- B. The following work shall be listed as a separate line item if the sub-contractor anticipates invoicing separately for the work:

- 01 Mobilization
- 02 Subcontractor temporary facilities
- 03 Subcontractor Bonds
- 04 Submittals
- 05 Shop Drawings
- 06 Rough-In

- 07 Fixtures / Equipment
- 08 Trim-Out
- 09 Close-Out Documents / Record Drawings

2.6 SCHEDULE OF VALUES FOR ALLOWANCE EXPENDITURES

- A. For Owner approved expenditures from Allowances included in the Contractor's Proposal, the Application for Payment shall include a separate, supplemental spreadsheet in the same format as AIA G703.
 - 01 Provide a separate supplemental spreadsheet for each Allowance included in the Contract.
- B. Each approved Allowance expenditure item shall be listed separately with the authorized / scheduled value identified in Column "C".
- C. Progress on each expenditure shall be tracked on the supplemental spreadsheet (i.e. previously billed, work this period, overall completion percentage, etc.).
- D. The Master Application for Payment shall include ONLY totals from each Allowance supplemental spreadsheet for each application period.

END OF SECTION

SECTION 01 29 76

PROGRESS PAYMENT PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 This Section establishes the procedures for submitting progress Pay Applications during the Contract Administration phase.
- B. Related Work:
 - 01 Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 - 02 Section 01 29 73 – Schedule of Values.

1.1 SUBMITTALS

- A. Provide draft application for each Pay Application to the Arcadis Field Representative.
- B. Provide progress Pay Applications in accordance with the Owner-Contractor Agreement.
- C. Submission of Pay Applications in either hard copy and / or electronic format shall be defined in the Owner-Contractor Agreement or at the pre-construction meeting.

1.2 QUALITY ASSURANCE

- A. Use all required means to assure mathematical accuracy of the sums described.
- B. When so required by the Architect, provide copies of the subcontracts or other data acceptable to the Architect, substantiating the sums described.
- C. The Schedule of Values shall be broken down into costs for each Specification Section as labor and materials at a minimum.
 - 01 The Contractor is encouraged to make the schedule of values very detailed in order to facilitate review and approval of requested percentages complete on Pay Applications.
 - 02 Where breakdown is vague, or includes multiple / combined assemblies, stages, tasks, etc., Architect's review shall be conservative in favor of the Owner regarding approval of Pay Applications.

1.3 MULTIPLE PHASES / BUILDINGS AND ALTERNATES

- A. For projects consisting of multiple phases, separate each phase on the Application for Payment and include separate Division 1 through 32 line-items for each phase.
- B. For projects consisting of multiple buildings, separate each building on the Application for Payment and include separate Division 2 through 28-line items for each building.
- C. If applicable to multi-phase / multi-buildings projects, site work may be shown separately from phases and / or buildings. Coordinate with Architect as required for approval.
- D. Owner accepted Alternates which are “stand alone” Scopes of Work, not integrated into the Base Bid / Proposal Scope of Work, shall be listed separately with each Alternate having its own corresponding schedule of values.

PART 2 - PRODUCTS

2.1 APPLICATION FOR PAYMENT

- A. Application for Payment shall be made using AIA G702/G703 – Application for Payment to be used for all progress payments.
 - 01 Other non-AIA programs proposed by the Contractor may be considered; however, the formatting and content must match AIA G702/G703.
- B. Once AIA G702/G703 – Application for Payment has been submitted for payment, individual line-item amounts in Column C **must remain unchanged throughout the progress of the Work.**
 - 01 In the beginning stages of the construction, total amounts for entire Divisions may be used if complete breakdowns are not available; and shall be line-item populated as soon as practical.
 - 02 No payments will be approved in a Division that does not have a complete, approved line-item breakdown.
- C. Format of listed line-items of Application for Payment shall sequentially follow the CSI format of the Specifications.

2.2 OWNER ALLOWANCE EXPENDITURES

- A. The primary Application for Payment shall include a single line item for each Owner Allowance included in the Contract, with the total allowance amount stated in Column C.
- B. The Application for Payment shall include a separate, supplemental spreadsheet in the same format as AIA G703 for each Owner Allowance.
 - 01 Provide a separate supplemental spreadsheet for each Allowance included in the Contract.
 - 02 Supplemental allowance spreadsheets shall include Columns A through I as described on AIA G703.
- C. Each allowance expenditure authorization (AEA) shall be listed separately with the authorized / scheduled value identified in Column “C”.

- 01 Each item (CPR) included in the AEA shall be listed separately for each AEA, with scheduled value included for each item.
- D. Progress on each AEA item shall be tracked on the supplemental spreadsheet (i.e. previously billed, work this period, overall completion percentage, etc.).
- E. The Master Application for Payment shall include ONLY totals from each Allowance supplemental spreadsheet for each application period.

PART 3 - EXECUTION

3.1 APPLICATION FOR PAYMENT

- A. General provisions for submitting, approving and processing Applications for Payment is described in the Owner-Contract Agreement, General Conditions and / or Supplementary Condition. In addition to these provisions, the following provisions will also be required.
- B. Once line-item scheduled values (Column C) have been approved by the Architect, those values **must remain constant without revision throughout the construction phase.**
 - 01 Exception: The only exception to modifications of Column C shall be properly executed Change Orders which affect the Contract amount.
 - 02 The amount of the Change Order shall be reflected in an added line item at the end of the Application for Payment.
- C. Preliminary Draft:
 - 01 The Contractor shall provide a draft of their proposed Application of Payment (the Draft), including supplemental Owner allowance sheets, for each pay period to the Architect's Field Representative.
 - 02 The Draft shall be a copy of the most recent Application for Payment that has been approved (i.e. previous month).
 - 03 The Draft shall be red-lined / marked with percentages complete in Column G for the current proposed Application for Payment.
 - 04 The Architect's Field Representative shall review the Draft on-site with the Contractor's selected personnel (i.e. superintendent or project manager).
 - 05 Any revisions to the Draft shall be noted, discussed and agreed upon by both the Contractor and Architect's Field Representative.
 - 06 Upon agreement of all revisions, both the Contractor and Architect's Field Representative shall initial the front page of the Draft.
 - 07 The Contractor shall provide a copy of the final, initialed Draft to the Architect's Field Representative for record.
- D. Application for Payment:
 - 01 The Contractor's submitted Application for Payment for approval shall reflect all percentages complete, including revisions, agreed upon by the Contractor and Architect's Field Representative.
 - 02 The Application for Payment shall include an attached copy of the final, initialed Draft.
 - 03 The Application for Payment shall include Allowance supplementary spreadsheets.
- E. Applications for Payment which do not include the above requirements shall be rejected and returned to the Contractor without processing.

- F. The General Contractor will be responsible to enter the Application on the Owners Project Management Software (Projectmates)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT SOFTWARE

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. This Section specifies administrative and procedural requirements necessary for project management utilizing on-line project management software.
 - 01 Owner designated project management software – Projectmates.
- C. Related Work:
 - 01 Section 01 31 13 – Project Coordination
 - 02 Sections 01 29 76 – Progress Payment Procedures
 - 03 Section 01 33 00 – Submittal Procedures
 - 04 Section 01 77 00 – Close-Out Procedures

1.2 QUALITY ASSURANCE

- A. The Owner shall provide live training and / or tutorial training videos to key Contractor personnel, including but not limited to:
 - 01 Project manager and assistant project managers as applicable
 - 02 Project superintendent and assistant superintendents as applicable
 - 03 Administrative support staff
 - 04 Others as requested by the Contractor or Architect
- B. The Contractor shall designate one member of his project team that will be responsible for assuring proper, timely and continuous usage of the project management software throughout the duration of the project.
 - 01 Contractor's personnel shall become proficient in the use of the software.
- C. Contractor shall ensure usage of the project management software throughout the project.
 - 01 In the event any Contractor key personnel are replaced or new key personnel are brought into the project team, the Contractor shall ensure the replacement personnel are trained and become proficient in the use of project management software.

PART 2 - PROJECT MANAGEMENT ELEMENTS

2.1 SUBMITTALS

- A. Refer to section 01 33 00 – Submittal Procedures for specific information regarding the requirements for submittals.

- B. All submittals shall be submitted in electronic format except physical samples and mock-ups, unless otherwise agreed to by the Architect.

2.2 REQUEST FOR INFORMATION - RFI

- A. An RFI shall be submitted by the Contractor to the Architect to obtain project information where pertinent information is not readily identifiable in the Contract Documents.
- B. The Contractor is not limited on the reason for submitting an RFI; however, the Contractor shall perform a thorough review of the Contract Documents to assure the needed information is not already included in the Contract Documents.
- C. Where there are discrepancies between different parts of the Contract Documents, the Contractor is required to submit an RFI for clarification prior to proceeding.
 - 01 The Contractor assumes full responsibility of the work – acceptable or not acceptable – if he proceeds without submitting an RFI.
 - 02 Note: In cases of discrepancy the General Conditions of the Contract require the Contractor and subcontractors to base their proposal on the most quantity and / or best quality, as applicable.
- D. Whenever possible, for each RFI, the Contractor shall provide a suggested / recommended answer or solution to the RFI.

PART 3 – EXECUTION

3.1 PROJECT MANAGEMENT PROCESSES

- A. The following elements of the project shall be generated, communicated, and managed through the Owner's project management software:
 - 01 Submittal processing.
 - 02 Request for information (RFI) processing.
 - 03 Architect's Supplemental instructions (ASI) processing
 - 04 Change proposal request (CPR) processing
 - 05 Allowance expenditure authorization (AEA) processing
 - 06 Punch list processing
 - 07 Warranty processing
- B. Contractor Initiated Elements: The Contractor shall initiate processing of the following elements:
 - 01 Submittal processing.
 - 02 Request for information (RFI) processing.
- C. Architect Initiated Elements: The Architect shall initiate processing of the following elements:
 - 01 Architect's Supplemental instructions (ASI) processing
 - 02 Change proposal request (CPR) processing
 - 03 Allowance expenditure authorization (AEA) processing
 - 04 Punch list processing
 - 05 Warranty processing

3.2 SUBMITTAL PROCESSING

- A. The Contractor shall initiate transmission of all submittals through the project management software.
 - 01 Refer to section 01 33 00 – Submittal Procedures for required submittal numbering, grouping and Contractor review.
- B. Distribution lists for submittals shall be as agreed upon by the Architect and Contractor, which shall vary depending on the specific submittal subject.
 - 01 Coordinate with Architect to develop distribution lists prior to the start of the submittal process.
- C. The Architect shall be responsible for transmitting all reviewed submittals, including consultant submittals, back to the Contractor.
 - 01 The project management software will auto-generate an email notification to the Contractor that the submittal response / review is complete and available.
 - 02 The email shall include a link to the submittal response / review.

3.3 RFI PROCESSING

- A. The Contractor shall initiate transmission of all RFI's through the project management software.
- B. RFI numbering shall be sequential
- C. The contractor shall fill out the following fields:
 - 01 RFI subject
 - 02 RFI recipient, which shall be the Architect's designated recipient for RFI's
 - 03 Other recipients to be copied on the RFI.
- D. There are two options available to convey the text of the RFI:
 - 01 Type the RFI and proposed solution directly into the relative fields on the project management software RFI page. Any supplementary documents may be attached / uploaded on the RFI page.
 - 02 Attach / upload the RFI and proposed solution using the Contractors standard RFI form directly on the project management software page.
 - 03 If option 2 is utilized, the RFI number on the Contractor's attached RFI form must match the RFI number created.
- E. RFI responses from the A/E recipient shall be returned to the Contractor through the project management software.
 - 01 The project management software will auto-generate an email notification to the Contractor that the RFI response is complete and available.
 - 02 The email shall include a link to the RFI response.

3.4 ASI PROCESSING

- A. The Architect shall initiate transmission of ASI's to the Contractor through the project management software.
- B. ASI numbering will be auto generated by the architect.
- C. Similar to RFI's, the ASI may be written directly on the project management software page, and / or included as an attachment.

- D. The project management software will auto-generate an email notification to the Contractor that the ASI has been transmitted.
- E. Once an ASI is received by the Contractor, no further administrative action is required by the Contractor, with the following exception:
 - 01 If the Contractor believes a directive given in an ASI should result in additional cost or contract time, the Contractor shall have a maximum of seven (7) calendar days to notify the Architect.
 - 02 Failure of such notification shall represent the Contractor's agreement that the ASI directive(s) do not result in additional cost or additional time.

3.5 CPR PROCESSING

- A. The Architect shall initiate transmission of CPR's to the Contractor through the project management software.
- B. CPR numbering will be auto generated by the project management software.
- C. The project management software will auto-generate an email notification to the Contractor that the CPR has been transmitted.
- D. Contractor CPR Response: The Contractor shall provide a response to each CPR that includes, but is not limited to the following:
 - 01 Cover letter identifying the CPR and subject, including the net overall cost or credit of the CPR.
 - 02 Summary sheet of material and labor of relative work to be self-performed by the Contractor.
 - 03 Summary sheet for total expense / credit from each involved subcontractor to include:
 - a. An itemized list of materials with itemized costs and shipping costs as applicable.
 - b. Personnel, labor rates and total labor for each category
 - c. Equipment costs
 - d. Markup(s) as allowed by the Contract.
 - e. Summary of all costs
 - 04 All subcontractor pricing documents substantiating their pricing.
 - 05 Copy of the original CPR.
- E. Prior to submitting a CPR response to the Architect, the Contractor shall thoroughly review all submitted subcontractor back-up.
 - 01 Confirm scope of work is complete and accurate.
 - 02 Confirm reasonableness of all material and labor costs.
 - 03 Confirm markup(s) are in accordance with Contract allowances.

3.6 AEA PROCESSING

- A. The Architect shall initiate transmission of AEA's to the Contractor through the project management software.
- B. Upon receipt, the Contractor shall affix his signature and date and return to the Architect through the project management software.
- C. The Architect shall forward to the Owner for signature and return to the Architect.

- D. Once the AEA has been fully executed, the Architect shall distribute to the Contractor and Owner.
 - 01 The final, executed AEA shall have all relative CPR's attached for record.

3.7 PUNCH LIST PROCESSING

- A. Refer to section 01 77 00 – Close-Out Procedures for additional punch list requirements.
- B. All punch lists shall be completed using using Plans App, an application to describe punch list items with the ability to utilize floor plan and photo inserts to better delineate the punch list item.
 - 01 Plans App is a free app to be downloaded to an iPad or similar device.
 - 02 The Architect shall provide training to the Contractor for using Plans App.
- C. The information to be filled in includes the following:
 - 01 Item Number: auto assigned by Plans App
 - 02 Contract Document Room Number
 - 03 Building Room Number
 - 04 Walk-Thru Date
 - 05 Author
 - 06 Item Category: obtained from a drop down menu
 - 07 Item Description: obtained from a drop down menu
 - 08 Comments
 - 09 GC Completion Sign-Off
 - 10 Architect Sign-Off
 - 11 Floor Plan Insert (Option to turn off where not necessary)
 - 12 Photo Insert (Option to use or not use as needed)
- D. Upon receipt of the Contractor's punch list, the Architect shall provide supplementation using the Plans App software application.
- E. Implementing Correction of Punch List Items:
 - 01 The Contractor shall take action to address all punch list items.
 - 02 Upon confirming the item has been correctly and completely addressed, the Contractor shall:
 - a. Designate such by filling in GC Sign-Off field
 - b. Provide photographic documentation of the correction directly into the Plans App software.
- F. Upon delivery of the completed punch list, the Architect (or consultant) shall back check the punch to verify the item has been satisfactorily addressed.
 - 01 It shall be the Architect's sole discretion to back-check partially completed punch lists.

3.8 WARRANTY PROCESSING

- A. Upon receiving warranty information from the Owner, the Architect shall vet the item to determine it is or is not a warranty item covered under the Contractor's contractual warranty.
- B. If legitimate, the warranty shall be processed using the project management software.
- C. The Contractor shall receive notification of the warranty item by email, at which point he shall view the warranty item on the project management software.

- D. The Contractor shall address all warranty items using his own personnel or by assignment to the responsible subcontractor.
- E. Wherever possible, all warranty items shall be addressed within a seven (7) day period; and where not possible, the Contractor shall advise the Architect:
 - 01 Of why the item shall require more time, and
 - 02 The anticipated correction completion date for the item.
- F. Upon completion, the Contractor shall designate such through the project management software.
 - 01 Where appropriate, the Contractor shall upload photo documentation of the completed warranty work.

END OF SECTION

SECTION 01 31 13

PROJECT COORDINATION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
This Section specifies administrative and procedural requirements necessary for coordinating Work operations including, but not limited to, the following:
 - 01 General coordination procedures
 - 02 Coordination CAD Drawings
 - 03 Coordination Revit models
- C. Related Work:
 - 01 Section 01 32 16 – Construction Progress Schedule
 - 02 Section 04 20 00 – Unit Masonry
 - 03 Section 05 12 00 – Structural Steel Framing
 - 04 Section 05 41 00 – Structural Metal Stud Framing
 - 05 Section 09 21 16 – Gypsum Board Assemblies
 - 06 Section 09 51 13 – Acoustical Tile Ceilings
 - 07 Division 21 – Fire Protection
 - 08 Division 22 – Plumbing
 - 09 Division 23 – HVAC
 - 10 Division 26 – Electrical

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Submit two (2) copies of all AutoCAD Coordination Drawings printed on 30" x 42" format sheets; and additionally, one (1) electronic copy of all Coordination Drawings.
 - 01 A/E team shall provide AutoCAD files to the Contractor for use in developing Coordination Drawings.
- C. Submit an electronic Revit (model) file containing all proposed work requiring coordination; and additionally, 2 copies printed on 30" x 42" format sheets; and additionally, one (1) electronic copy of all Coordination Drawings.
 - 01 A/E team shall provide Revit files to the Contractor for use in developing coordination models.
- D. Submission and resubmission of Coordination Drawings / Models shall continue until all conflicts have been fully resolved and agreed upon by Architect, Contractor and Owner.
 - 01 AutoCAD: Upon resolution of all conflicts, submit two (2) copies of final Coordination Drawings, and, one (1) electronic copy of all Coordination Drawings in AutoCAD format for implementation of the Work.

- 02 Revit: Upon resolution of all conflicts, submit one (1) electronic Revit (model) file; and two (2) copies of final Coordination Drawings in PDF format.
- E. Contractor shall maintain copies of all Coordination Drawings at the project site; and distribute copies to subcontractors as required to assure adherence to the conflict-free Drawings.
- F. Submittal Coordination: Contractor shall devise a process for each subcontractor to use to clearly identify his work, including the ability to isolate a particular subcontractor's work.
 - 01 For printing purposes, assign a color code each subcontractor.
 - 02 Electronically for AutoCAD or Revit, assign a separate layer for each subcontractor.

1.3 QUALITY ASSURANCE

- A. Coordination Drawings shall be based on field measurements, submittals, Shop Drawings and product data proposed to be furnished.
- B. Coordination Drawings shall be comprised of plans, sections and elevations as required to accurately depict proposed installation of interfacing and adjacent installations and assemblies.
- C. Coordination Models shall be comprised of all components required to accurately depict proposed installation of interfacing and adjacent installations and assemblies.
- D. Coordination Drawings / Models shall be prepared early enough in the construction process to allow time for review, and to identify and resolve conflicts without delaying the progress of the Work.
- E. Contractor's untimely submission of Coordination Drawings which result in subsequent conflicts that could have been averted by timely submission shall result in the Contractor's responsibility to bear the cost(s) to remedy the conflict(s).

PART 2 - PRODUCTS

2.1 COORDINATION DRAWINGS

- A. Plan Views: Coordination Drawings shall be submitted in plan form with sufficient detail to fully describe the Work, and shall include, but not be limited to:
 - 01 Structural steel framing
 - 02 Mechanical ductwork
 - 03 Fire sprinkler piping
 - 04 Plumbing - roof and secondary drains
 - 05 Partitions
 - 06 Ceiling fur-downs
- B. Elevation / Sectional Views: Coordination Drawings for mechanical rooms and central plant shall include elevation and sections through proposed work in addition to plan views; and shall include, but not limited to:
 - 01 Structural elements
 - 02 Masonry
 - 03 Partition framing
 - 04 HVAC equipment
 - 05 Ductwork – supplies and returns

- 06 Electrical gear (panelboards and transformers)
 - 07 Other major components as required to confirm coordination of assemblies.
- C. Shop Drawings shall depict actual proposed project conditions related to each assembly.
- D. All dimensions indicated on the Drawings are based on the specific models and manufacturers of products, equipment, fixtures and miscellaneous items specified or used as a design basis.
- 01 If the Contractor uses an approved product by another listed manufacturer which is different than the specific model and manufacturer listed in these Specifications, the Contractor shall be solely responsible for the coordination of any dimensional changes required, including structural, relocation of walls, equipment, fixtures, ceilings and miscellaneous items – all subject to approval by the Architect.
 - 02 When dimensional changes are required in these situations, the Contractor shall submit a proposed Modification Drawing to the Architect for approval prior to proceeding with the Work. All causes and effects of the dimensional change shall be indicated on the Contractor's Drawing submittal.

2.2 COORDINATION MODEL

- A. Coordination models in Revit shall be complete to the point that all elements required for coordination are accurately depicted; and shall include, but not be limited to:
- 01 Structural steel framing
 - 02 Mechanical ductwork
 - 03 Fire sprinkler piping
 - 04 Plumbing - roof and secondary drains
 - 05 Partitions
 - 06 Ceiling fur-downs
 - 07 Ceiling planes
- B. Prior to the coordination meeting, the Contractor shall run the model through conflict resolution software (i.e., Navis Works, or similar) to identify all conflicts in the model.
- 01 Provide the conflict report generated by the conflict resolution software at the review meeting(s).
- C. All dimensions indicated on the Drawings or included on A/E Revit models are based on the specific models and manufacturers of products, equipment, fixtures, and miscellaneous items specified or used as a design basis.
- 01 If the Contractor uses an approved product by another listed manufacturer which is different than the specific model and manufacturer listed in these Specifications, the Contractor shall be solely responsible for the coordination of any dimensional changes required, including structural, relocation of walls, equipment, fixtures, ceilings, and miscellaneous items – all subject to approval by the Architect.
 - 02 When dimensional changes are required in these situations, the Contractor shall submit a proposed Modification Drawing to the Architect for approval prior to proceeding with the Work. All causes and effects of the dimensional change shall be indicated on the Contractor's Drawing submittal.

PART 3 – EXECUTION

3.1 COORDINATION - GENERAL

- A. Contractor shall coordinate operations included in various Sections of Contract Documents to assure efficient and orderly installation of each part of Work. Coordinate Work operations included under related Sections of Contract Documents that depend on each other for proper installation, connection, and operation of Work, including but not limited to:
 - 01 Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.
 - 02 Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 - 03 Provide provisions to accommodate items scheduled for later installation.
 - 04 Prepare and administer provisions for Coordination Drawings.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work. Such administrative activities include, but are not limited to, following:
 - 01 Preparation of schedules.
 - 02 Installation, relocation, and removal of temporary facilities.
 - 03 Delivery and processing of submittals.
 - 04 Progress meetings.
 - 05 Project closeout activities.
- C. Contractor will be responsible for the overall coordination review. As each Coordination Drawing is completed, Contractor will meet with Owner to review and resolve all conflicts on Coordination Drawings.
- D. Coordination meetings will be held in Project field office of Contractor. Contractor is required to distribute Shop Drawings, cut sheets and submittals to subcontractors where appropriate. Reviewed Coordination Drawings will be maintained in Project field office of Contractor. Meeting minutes shall be developed by Contractor and submitted to Owner and Architect within five (5) days.
- E. The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, product data, samples or similar submittals until the respective submittal has been reviewed by the Architect / Consultant without request for re-submittal.

3.2 SCHEDULE

- A. The Contractor shall schedule to complete the Coordination Drawing / model submittal process prior to completion of submittal review of any trades, components or assemblies included in the Coordination Drawings.
- B. The Contractor shall formulate and provide a submittal schedule to the Architect within twenty (20) days after execution of the Owner – Contractor Agreement, to allow for proper coordination and scheduling reviews.

- C. In formulating the Coordination Drawing schedule, the Contractor shall allow the following review periods for Coordination Drawings:
- 01 Architect – allow fourteen (14) calendar days response time, after Architect's receipt, for all submittals made to and reviewed by the Architect.
 - 02 Architect's Consultant – Allow twenty (20) calendar days response time, after Consultant's receipt, for all submittals which must be reviewed by Architect's Consultants.
 - 03 All Consultant submittals shall be returned to the Architect for delivery to the Contractor.
- D. In formulating the coordination Revit model schedule, the Contractor shall allow the following review periods for Coordination Drawings:
- 01 Review shall be electronically by the Contractor, subcontractors, Architect, Consultants and Owner.
 - 02 Contractor shall schedule review meeting(s).
 - 03 Allow an appropriate time period of meetings to thoroughly review identified conflicts and get consensus of the conflict resolution by all parties.

END OF SECTION

SECTION 01 31 19

PROJECT MEETINGS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Contractor participation in preconstruction conference.
 - 02 Contractor administration of pre-installation conferences.
 - 03 Contractor administration of progress meetings
- C. Related Work:
 - 01 Section 01 31 13 – Project Coordination
 - 02 Section 01 31 29 – Notification of Architect Requirements

1.2 PRECONSTRUCTION CONFERENCE

- A. Architect will administer preconstruction conference prior to the Contractor's mobilization on site.
- B. Agenda of the preconstruction conference shall include, but not limited to:
 - 01 Introduction of project teams for Contractor, Architect, Program Manager and Owner.
 - 02 Contractor's submission of bonds and insurance certificates, if not already submitted.
 - 03 Review communication protocols.
 - 04 Review responsibilities of Contractor, Architect, Program Manager and Owner.
 - 05 Establish day and time for weekly Owner site meetings.
 - 06 Review Contractor's proposed schedule.
 - 07 Review and agree upon Contractor's site mobilization and location of job-site trailer.

1.3 PRE-INSTALLATION CONFERENCES

- A. Contractor shall convene pre-installation conferences with each sub-contractor prior to commencing work of the sub-contractor.
 - 01 Contractor shall record attendance on a sign-in sheet.
 - 02 Contractor shall keep minutes of the conference and distribute to all attending parties prior to the start of the Work.
- B. The purpose of the meeting is to fully review subcontractor's work to assure initial installation will be in accordance with the Contract Documents.

- C. The agenda shall include, but not limited to the following:
 - 01 Review the contract documents, including any changes thereto.
 - 02 Review all RFI's that may affect the Work.
 - 03 Review the final reviewed submittals, including AE and Contractor comments.
 - 04 Review conditions of installation, preparation and installation procedures.
 - 05 Review coordination with related / interfacing work.
 - 06 It is the responsibility of the Contractor / sub-contractor to resolve all unknown issues, unclear issues, coordination issues, and assembly interface issues in order to comply with the requirements of the Contract Documents.
- D. Require attendance includes, but is not limited to the following:
 - 01 Contractor's superintendent
 - 02 Architect's Field Representative
 - 03 Relative sub-contractor
 - 04 Other sub-contractors whose work may be affected by the relative sub-contractor.
- E. Pre-installation conferences shall be scheduled a minimum of forty-eight (48) hours in advance of the start of relative work unless otherwise agreed to by all parties.
- F. Pre-installation conferences may be scheduled with multiple sub-contractors at the same time to facilitate awareness of related work. Coordinate with Architect's Field Representative.
- G. The Contractor shall keep meeting minutes and distribute to all attendees within three (3) days after the meeting; or sooner if required to facilitate project scheduling.

1.4 PROGRESS MEETINGS

- A. Contractor shall schedule and administer all project meetings after mobilization conference throughout progress of the Work at bi-weekly intervals, plus any special called meetings, and all pre-installation conferences.
- B. Contractor shall make physical arrangements for meetings, preside at meetings, record minutes, and distribute copies of minutes within two (2) days to attendees, and those affected by decisions made at meetings.
- C. Required Attendance:
 - 01 Contractor's Superintendent
 - 02 Contractor's Project Manager
 - 03 Architect's Project Manager
 - 04 Architect's Field Representative
 - 05 Architect's Consultants as appropriate to agenda topics for each meeting.
 - 06 Owner's Representative(s).
- D. The primary purpose of the weekly progress meetings is to update the Owner of the project status, progress, schedule and outstanding issues. It shall not be a venue for resolving issues that can otherwise be resolved between the Contractor and Architect / Consultants; unless direct input from the Owner is required.

01 In as much as practical, meetings shall be scheduled on the same day and time each week. Changes in the normal schedule must be agreed to by all parties.

- E. Agenda: The agenda for progress meetings shall include, but not be limited to:
- 01 Review work completed since the previous meeting.
 - 02 Review the Contractor's two-week look ahead schedule.
 - 03 Review status of progress schedule and adjustments thereto, and delivery schedules.
 - 04 Review submittal log,
 - 05 Review RFI log.
 - 06 Review change proposal log, minor changes and other adjustments to the Work
 - 07 Review pending changes and substitutions.
 - 08 Review A/E construction observation reports and resolutions to outstanding issues
 - 09 Review as-built documents and close-out progress,
 - 10 Discuss other items affecting progress of work.
 - 11 New business

1.5 PROGRESS MEETING MINUTES

- A. Meeting minutes shall be produced in a form acceptable to the Architect.
- 01 Contractor shall submit a sample meeting minutes format to the Architect for review and acceptance prior to the first meeting.
- B. Progress meeting minutes shall be kept and furnished by the Contractor and shall be structured to identify all discussion topics, action items and responsible party for action items.
- 01 A topic discussed that requires an action shall be identified by the date of the initiating meeting, the agreed upon due date of response and the party responsible for the action.
- C. Each meeting with unresolved information or pending action items shall remain on the meeting minutes through one meeting beyond resolution or completion of the pending action of the item, where the item can be reviewed one more time and all parties agree the item can be closed and removed from the meeting minutes.
- D. The last meeting shown on the meeting minutes shall relate to the most recent meeting held and shall include all topics of discussion at that meeting.
- E. The Contractor shall distribute meeting minutes to the Owner, Program Manager and Architect within three (3) days after the meeting and additionally, paper copies of the previous meeting minutes shall be furnished to all attendees at the beginning of each meeting.

END OF SECTION

SECTION 01 31 29

NOTIFICATION OF ARCHITECT REQUIREMENTS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. In general, the Contractor shall notify the Architect and / or Architect's Consultants whenever there is need of clarification of interpretation of the Contract Documents.
- C. Additionally, the Contractor shall notify the Architect and / or Architect's Consultants at specific phases of the Work in order to observe work in place or in progress.
- D. The Project Superintendent shall notify the Architect's and Consultant's Field Representative on a regular basis of the ongoing Work.

PART 2 - NOTIFICATIONS

2.1 ARCHITECT / CONSULTANT NOTIFICATION

- A. The Contractor shall notify the Architect and / or Architect's Consultant a minimum forty-eight (48) hours in advance of certain stages of construction to observe and verify work is being installed in accordance with the Contract Documents.
 - 01 Notification shall be sent by email or other written means.
 - 02 For notices less than forty-eight (48) hours in advance, Architect / Consultant shall endeavor to accommodate the request; however, Contractor assumes all responsibility for schedule delays resulting from untimely notification.
- B. Notifications to the Architect shall include, but not necessarily be limited to the following:
 - 01 Mobilization on site.
 - 02 Start of asbestos abatement
 - 03 Start of full or partial demolition.
 - 04 Clearing of site / stripping of topsoil
 - 05 Placing of each lift of select fill material.
 - 06 Installation and cover of underground utilities.
 - 07 Installation of drilled / spread footings.
 - 08 Excavation / forming of grade beams.
 - 09 Placing of all concrete
 - 10 Installation of lightweight insulating concrete
 - 11 Installation of concrete masonry units.
 - 12 Installation of masonry veneer
 - 13 Completion of structural steel erection.
 - 14 Installation of metal decking.
 - 15 Installation of dampproofing / air barrier
 - 16 Installation and concealment of insulation
 - 17 Installation of roofing.

- 18 Installation and concealment of sheet metal work / flashing
 - 19 Installation of self-adhered sheet flashing.
 - 20 Installation of building and glazing sealants.
 - 21 Installation of hollow metal frames.
 - 22 Installation of exterior glazing framing and glass.
 - 23 Installation of plaster assemblies.
 - 24 Installation of ceiling grid.
 - 25 Installation of each type of finish flooring.
 - 26 Installation of each type of wall finishes.
 - 27 Installation of walkway covers.
 - 28 Installation of Food Service Equipment; also notify Food Service Consultant.
- C. In addition to notifying the Architect, the Contractor shall also notify the Civil Engineer prior to the following stages:
- 01 Installation and cover of underground site utilities.
 - 02 Installation and cover of manholes and other drainage structures.
 - 03 Installation of lift stations.
 - 04 Installation of storm detention ponds / systems.
- D. In addition to notifying the Architect, the Contractor shall also notify the Structural Engineer prior to the following stages:
- 01 Installation of drilled / spread footings
 - 02 Pouring of grade beams
 - 03 Placing of all building slab concrete
 - 04 Start and completion of structural steel framing.
- E. In addition to notifying the Architect, the Contractor shall also notify the MEP Engineer prior to the following stages:
- 01 Installation of underground service ductbank(s)
 - 02 Installation and cover of underground site electrical.
 - 03 Installation and cover of underground building electrical.
 - 04 Installation of ceiling grid and cover-up.
 - 05 Completion of plumbing rough-in.
 - 06 Installation of plumbing fixtures
 - 07 Installation of HVAC equipment
 - 08 Completion of rigid duct installation
 - 09 Completion of electrical rough-in
 - 10 Installation of all electrical fixtures
 - 11 Any and all testing specified for equipment, mechanical, electrical and plumbing systems.
 - 12 Refer to MEP Specifications for additional information and requirements.
- F. In addition to the above requirements, Architect and Consultant(s) shall be notified of all equipment testing, startup procedures, and Owner demonstrations / training sessions.

2.2 INCLEMENT WEATHER NOTIFICATION

- A. Owner-Contractor Agreement – Substantial Completion based on calendar days: If the project delivery includes time extensions for interruption or delay of Work due to inclement weather, the Contractor shall adhere to the following procedures for consideration of approval of the weather delay time extension requests:
- 01 Provide email notification to the Architect of each regular work day delay within twenty-four (24) hours of the delay (i.e. following day – latest)

- 02 Provide email notification to the Architect of any delays resulting from inclement weather on non-workdays or holidays not later than the end of the first subsequent work day.
- 03 Notifications shall include the type of weather, nominal quantity of rain / wind velocity (as applicable) and description of how the event delayed the project.
- 04 If a single weather event results in a multiple-day delay, provide notification for each day in accordance with the above procedures.
- 05 The General / Supplementary Conditions to the Owner-Contractor Agreement requires allowance for average, normal rain days per month which must be accounted for in the Contractor's baseline schedule and / or Proposal calendar days. Provide notifications for all weather event delays, regardless of required rain days included in the Contractor's schedule.
- 06 Provide a monthly inclement weather summary log with the Application for Payment. The log shall include actual weather delay days for the month, required anticipated weather days and the net add / gain for the month; as well as a cumulative summary of all such reports.
- 07 Provide a monthly updated schedule with the Application for Payment. The schedule should reflect the weather delay impact on the critical path of the schedule.

B. Owner-Contractor Agreement – Guaranteed Substantial Completion: If the project delivery includes a guaranteed Substantial Completion Date, there is no allowance for Contract Time extension due to inclement weather; however, as a matter of record, the Contractor shall adhere to the following procedures recording the weather-related interruption or delays:

- 01 Provide email notification to the Architect of each regular workday delay within twenty-four (24) hours of the delay (i.e. following day – latest)
- 02 Provide email notification to the Architect of any delays resulting from inclement weather on non-workdays or holidays not later than the end of the first subsequent workday.
- 03 Notifications shall include the type of weather, nominal quantity of rain / wind velocity (as applicable) and description of how the event impacted the project schedule.
- 04 If a single weather event results in a multiple-day delay, provide notification for each day in accordance with the above procedures.
- 05 Provide a monthly inclement weather summary log with the Application for Payment. The log shall include actual weather delay days.
- 06 Provide a monthly updated schedule with the Application for Payment. The schedule should reflect the Contractor's adjustment to the schedule to make up weather delay days which impact the critical path of the schedule.

END OF SECTION

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Requirements of Contractor to produce and maintain a detailed Critical Path Schedule (CPM) construction schedule throughout the progress of work.
 - 02 Owner imposed limitations on the construction schedule.

1.2 SUBMITTALS

- A. Construction schedules shall be produced using a Critical Path Method, linking associated tasks and their impact on interfacing / subsequent work.
 - 01 Provide schedule in as much detail as practical to accurately monitor progress of the work and adherence to the schedule.
 - 02 Provide in both text and graphic formats.
- B. Preliminary CPM Construction Schedule: Within two (2) weeks after receipt of Notice to Proceed, submit a preliminary CPM construction schedule for review.
- C. Detailed CPM Construction Schedule: Within two (2) weeks after acceptance of the preliminary CPM construction schedule, submit a detailed CPM construction schedule for review.
- D. Baseline CPM Construction Schedule: Upon acceptance of the detailed CPM construction schedule, it shall be base-lined and referred to as the Project Schedule; and shall be used for schedule evaluation throughout the progress of the work.
- E. An updated CPM schedule shall be submitted with each monthly application for payment.
 - 01 Approval and process Contractor's applications for payment shall be contingent on receipt of an accurate updated CPM schedule.

1.3 QUALITY CONTROL AND QUALITY ASSURANCE

- A. The Contractor shall develop and maintain a Project Schedule in accordance with the requirements of this Section. The requirement for a Project Schedule is included to:
 - 01 Ensure adequate planning before and during the execution and progress of the Work in accordance with the allowable number of working days and milestones.

- 02 Assure coordination and execution of the work among various trades of the Contractor, subcontractors, suppliers, third party utility companies or other related entities that may be involved in the Project.
- B. The project schedule shall show the sequence and interdependencies of activities required for complete performance of the work. The Contractor shall be responsible for assuring all work sequences are logical and show a coordinated plan of the work. The project schedule shall employ computerized CPM planning, scheduling and progress reporting of the work as described in this specification. The Contractor shall create and maintain the schedule using project scheduling software approved by the Owner and Architect that utilizes the fundamentals of CPM for scheduling.
- C. The Contractor shall designate a schedule representative who shall be responsible for coordinating with the PM during development and maintenance of the Project Schedule.
- 01 The Contractor's representative shall have the expertise to operate the CPM software and be capable of rapidly evaluating alternate scenarios to optimize management capabilities.
- 02 The Contractor has the option to utilize qualified outside scheduling consultation for the assistance of developing and maintaining the Project Schedule, however, the use of an outside consultant does not relieve the Contractor of responsibilities for compliance of this specification.
- 03 The Contractor's schedule representative shall have complete authority to act for the Contractor in fulfilling the schedule requirements of the Contract, and if such authority is interrupted during the Contract, approval shall be obtained in writing by the PM.
- D. All activities shall have at least one predecessor and one successor unless approved by the PM. The exceptions are no predecessor is needed for the Notice To Proceed (NTP) milestone and no successor is needed for the Project Completion milestone.
- E. With the exception of the specified contract substantial completion milestone, the contractor shall not use any constraints of any type without prior approval of the Owner.
- F. The project substantial completion milestone shall be assigned a "Finish on or Before" constraint. The required contract finish date shall be assigned to track project delivery related to contract requirements.
- G. Each activity's "Activity ID" and "Activity Description" or "Task Name" shall remain unchanged throughout the duration of the project subsequent the baseline acceptance by the Owner.
- H. An activity's "Activity Description" may only be revised to clarify an activity's original scope. If the scope of an activity increases or decreases, a replacement activity shall be created.
- I. Owner acceptance shall be obtained prior to making any changes or revisions to an activity's "Activity Description".

1.4 RELIANCE UPON SCHEDULE

- A. The construction schedule will be an integral part of the Contract, and will establish conditions for various activities and phases of construction.
- B. The Owner, Architect and Architect's Consultant shall rely on the schedule to perform related and interfacing activities.
- C. Whenever the progress of the Work falls behind two weeks or more, the Contractor shall adjust the schedule accordingly to demonstrate how progress shall be adjusted to get back on the original schedule.

PART 2 - PRODUCTS

2.1 PRELIMINARY CPM CONSTRUCTION SCHEDULE

- A. The Preliminary CPM Schedule shall be the basis for the sequence of work during the first ninety (90) calendar days of the Contract while the Project Schedule is being developed, submitted, reviewed, and accepted. The Preliminary CPM Schedule shall be updated monthly. If the acceptance of the Project CPM Schedule extends beyond one month, the Preliminary CPM Schedule shall be updated according to the requirements stated in paragraph 3.03.
- B. The Preliminary CPM Schedule shall include:
 - 01 The Procurement activities to be accomplished (either in whole or in part) during the first ninety (90) calendar days of the Contract. The procurement activities shall include mobilization, shop drawing submittal, sample submittal, Architect / Engineer review and approval period, material fabrication and delivery of key and long-lead items. If portable swing space buildings are required for a project, the preliminary CPM schedule shall include milestones for relocation and installation of such swing space buildings.
 - 02 The construction activities to be accomplished (either in whole or in part) during the first ninety (90) days of the Contract. These activities shall be in units of whole working days.
 - 03 The approach to scheduling the remaining work or phases of work beyond the first ninety (90) calendar days of the contract. The work for each phase or milestone must be represented by at least one summary activity for each major item of work such that they cumulatively indicate the entire schedule, with critical project milestones. The approximate duration for each summary activity shall include the Contractor's best estimate for the work it represents.
 - 04 Submit a written narrative describing the Contractor's approach to mobilization, procurement, and construction during the first ninety (90) calendar days of the Project. The narrative shall elaborate on the basis for durations, major equipment to be used, and shall identify all major assumptions used to develop and support the schedule. The narrative shall also include the Contractor's description of the critical path work activity as represented in the Preliminary CPM Schedule.
- C. Diagram: Graphically show the order of all activities necessary to complete the work and the sequence in which each activity is to be accomplished.
- D. Activities shown on the diagram shall include, but not necessarily be limited to:

- 01 Project mobilization.
 - 02 Submittals and approvals of shop drawings and samples.
 - 03 Phasing of construction.
 - 04 Procurement of equipment and critical materials.
 - 05 Fabrication and installation of materials and equipment.
 - 06 Final clean-up.
 - 07 Final inspection and testing.
- E. Accurately track and incorporate delays caused by inclement weather and factors outside the Contractor's control.
 - F. Provide updated schedules at each regularly scheduled site progress meeting.

2.2 PROJECT CPM SCHEDULE

- A. The Project Schedule shall begin at the project NTP and incorporate the accepted Preliminary.
 - 01 CPM Schedule including all required revisions and applicable progress updating as warranted.
 - 02 The Project Schedule shall indicate a logical sequence of work for each project site (school) and major restrictions from the availability and use of manpower, material and equipment.
 - 03 Utilize the schedule in planning, scheduling, coordinating and performing the work under this Contract (including all activities of subcontractors, equipment vendors and suppliers).
 - 04 The Project Schedule shall indicate the sequence and interdependencies of activities required for complete performance of the Work.
- B. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity in workdays considering the scope and resources planned for the activity.
 - 01 In developing the Project Schedule, the Contractor shall be responsible for ensuring that subcontractor work scope and sequencing at all tiers, as well as its own work, is included.
 - 02 If a contract for a subcontractor has not yet been awarded for a certain portion of the work, the Contractor is responsible for the development of the schedule for the work as described under this section.
 - 03 After the subcontractor award of contract, the Contractor shall modify the current accepted schedule to reflect any changes or revisions for the subcontractor sequence of work.
 - 04 Under no circumstance or event, shall a schedule modification or revision under this paragraph extend a milestone.
 - 05 The Project Schedule shall comply with the various limits imposed by the scope of work and by any contractually specified intermediate milestone dates and completion dates.
 - 06 The degree of detail shall be to the satisfaction of the PM the A/E or the Owner.
- C. Provide sufficient detail and clarity of form and technique so that all work can be properly controlled, and progress monitored by the PM and A/E. The Project Schedule shall consist of, but not be limited to, the following criteria:
 - 01 Full detail of all major procurement activities including the activities and information contained within the Preliminary CPM Schedule. Break up all procurement activities for major components and long lead

- items to include submittal dates, fabrication duration, and expected delivery dates.
- 02 Full detail of all major construction activities including the activities and information contained within the Preliminary CPM Schedule. Add column for responsible party (i.e. owner, subcontractor trade, 3rd party, etc.) for all construction activities.
 - 03 Multiple Calendars shall be used for establishing Holidays and periods of non-work based on the School Operations Parameter Statement in the Project Information Section of Division 0, concrete curing activities, other weather, or ambient temperature sensitive construction activities, and or other work requiring overtime or double shift work.
 - 04 Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures, precipitation and/or saturated soil to ensure recognition, planning and anticipation of intermittent inclement weather throughout the project duration. In addition, activities of similar nature shall be assigned to independent calendars based on this weather data. Contractor to provide a Weather Log each month as part of their Schedule Submittal.
 - 05 Activity duration in whole working days with a maximum duration of ten (10) working days each, unless otherwise approved by the PM, except for non-construction activities including mobilization, procurement, and concrete curing activities.
 - 06 For projects where hazardous materials are present and require abatement by the Owner, such abatement activities may take place prior to the Contractor's mobilization and start of any work, or they may take place concurrently with the Contractor's work. In cases where abatement activities must take place concurrently with Contractor's work, the Contractor shall allow for these activities to be incorporated into the Project CPM Schedule as separate activity line items. The Contractor shall allow time for these activities to take place at the appropriate time within the project schedule and shall coordinate their work with such abatement activities.
 - 07 At a minimum, the following guidelines, intermediate and final milestones shall be included in the project schedules for each individual project site (school), except for activities that are specifically identified to be common for all the project sites for a multi-project bundle:
 - a. Notice to Proceed
 - b. Required Periodic Inspections (examples: rebar, utilities, electrical and mechanical rough-in, overhead and architectural
 - c. Time allotted for coordination with and execution of abatement activities
 - d. Specific Phase start and finish dates – renovations and additions
 - e. Preliminary CPM Schedule submission and acceptance
 - f. Project Schedule submission and acceptance
 - g. Building dry-in
 - h. Permanent power
 - i. Conditioned air available
 - j. Completed testing and acceptance of Life Safety Systems and other critical building components
 - k. Completion of ADA upgrades in restrooms
 - l. Commissioning, when project requires
 - m. Ten percent (10%) minimum float for the project
 - n. Substantial Completion
 - o. Final Completion

- p. Owner Turn-Over / Start-Up / Project Closeout Activity / Warranty Period / Owner Testing/Training
 - q. Earliest Date that Owner can occupy the affected portion of the building (by phase, by complete project, etc.). This shall include all necessary approvals, permits (Fire Marshall Acceptance, Certificate of Occupancy, etc.).
- D. Deliverable: Within thirty (30) calendar days after the Notice to Proceed, the Detailed CPM Schedule deliverable submitted by the Contractor shall include at a minimum, the following information:
- 01 Two (2) copies (preferably 8 ½ x 11) of the project schedule. The critical path shall be readily discernible in red ink.
 - 02 Two (2) copies of the written narrative as described in paragraph 3.01, B.5
 - 03 One (1) electronic copy (accessible format not pdf)
 - 04 A list of all rain days occurring over the past month. Each rain day shall be identified in the Weather Log.

2.3 SCHEDULE UPDATES

- A. After the Project Schedule is accepted by the PM and the Contractor, it shall be “baselined” and used as a comparison for future progress updates.
- 01 The accepted Project Schedule shall be updated on a monthly basis, or as directed by the Owner, throughout the duration of the work until final completion is met.
 - 02 The Contractor shall meet with the PM each month at a Project Progress Meeting to review the work progress update and PM comments regarding the Project Schedule update.
 - 03 The Contractor shall submit a schedule update no later than three (3) working days before the Project Progress Meeting for the PM to review and comment.
- B. Out-of-Sequence progress logic shall be reviewed by the contractor’s scheduler and corrected before submitting the progress update.
- C. The percentage of all work shall be calculated by estimating the actual remaining duration of each progressed activity. The data date of each schedule update shall be determined by the PM each month. Contractor prepared estimates of the percent completion of each scheduled activity and the necessary supporting data shall be submitted on or before the data date referenced above and shall include the following information:
- 01 One (1) original of the previous month’s Schedule Update indicating actual activity start and/or finish dates to date, and revised (current) remaining durations.
 - 02 A narrative report shall be included that indicates in writing those activities the Contractor plans to work on during the following update month and current or anticipated conditions that have delayed or may delay the work in order to discuss remedial action.
 - 03 The Contractor shall also explain, for work that reflects less than satisfactory progress, whether any uncompleted and/or upcoming work will (or will not) be affected in a like manner and the Contractors method of correction.
 - 04 Any additional written information necessary to support the updated schedule including explanations of revisions to activities: logic, durations, resources, etc.

- D. In case of disagreements at the project progress meeting concerning actual progress to date, the Owner's determination shall govern. Upon completion of the schedule update meeting, the Contractor shall revise the Schedule Update to reflect progress as of the date of the schedule update meeting and any approved revisions to the Schedule Update and carry out a computer produced calculation to determine the status of the Project Schedule.
- E. Each Schedule Update shall be forwarded to the PM within seven (7) calendar days after the schedule update meeting and shall include two (2) copies of the narrative report with the following information:
 - 01 Activities that have been added in the month of this Project Schedule Update.
 - 02 Activities that have been deleted in the month of this Project Schedule Update.
 - 03 Activities that have "Actual Starts" prior to the month of this Project Schedule Update and remain unfinished.
 - 04 Activities that have "Actual Starts and Actual Finishes" in the month of this Project Schedule Update.
 - 05 A description of any approved revisions to the activity descriptions, schedule logic, or initial activity durations.
 - 06 One (1) print of the updated CPM Schedule Update indicating the progress made up to the date of the schedule update and indication of any revisions to the CPM Schedule Update.
 - 07 Two (2) prints of the written narrative as described in paragraph 3.03, B.3.
 - 08 A list of all rain days occurring over the past month. Each rain day shall be incorporated into the Project Schedule Calendar.
- F. If the Contractor's monthly progress schedule update reflects, or PM determines, that the Contractor is at least ten percent (10%) or at least negative seven (-7) calendar days behind the "baselined" schedule, the Contractor shall provide a revised or recovery schedule.
 - 01 The Contractor's revised or recovery schedule must incorporate a proposed plan for bringing the work back on schedule and completing the work by the contract completion date at no additional expense to the PM or Owner.
 - 02 A narrative indicating the revised approach to schedule recovery is to accompany the recovery schedule submittal. The revised or recovery schedule shall be in accordance to paragraph 2.08.

2.4 PROJECT FLOAT TIME

- A. Float time is not for the exclusive use or benefit of either the Contractor or the Owner. Contractor's work shall proceed according to early start dates, and the Owner shall have the right to reserve and apportion float time according to the needs of the Project.
- B. The Contractor acknowledges and agrees that actual delays, affecting paths of activities containing float time, will not have any affect upon contract completion times, providing that the actual delay does not exceed the float time associated with those activities.

PART 3 - EXECUTION

3.1 RELIANCE ON SCHEDULE

- A. The Architect and Owner shall rely on the Contractor's CPM schedule with respect to work progress and projected schedules for critical path work.
- B. An updated CPM schedule shall be submitted with each monthly application for payment.
 - 01 Approval and process Contractor's applications for payment shall be contingent on receipt of an accurate updated CPM schedule.

3.2 CONSTRUCTION SCHEDULE LIMITATIONS

- A. Work performed under this Contract shall be performed in accordance with the following paragraphs so that the Owner can accept the project as substantially complete as noted below.
- B. When the Owner-Contractor Agreement stipulates a guaranteed completion date, the Contractor shall use all means necessary to assure adequate progress of the Work to achieve the contracted Substantial Completion date.
 - 01 Refer to section 01 23 00 – Alternates for modifications and revisions to provisions of the General Conditions regarding a guaranteed substantial completion date.
 - 02 Time extensions will only be considered for Owner requested changes that directly impact the critical path of the schedule.

3.3 OWNER CHANGES IN THE WORK

- A. The Contractor shall evaluate Owner requested change in the work with respect to impact, if any, to the critical path of the schedule.
- B. Responses to Owner requested changes, CPR's and similar documents shall include a full description of schedule impact, if any.
 - 01 For changes the Contractor believes will affect the critical path of the schedule, provide a revised CPM schedule, or portion thereof that clearly delineates the impact.
 - 02 Architect and Owner shall evaluate schedule impacts and such information may be a criterion for approval to move forward with the change, or not.
 - 03 Owner approved changes that do not affect the critical path of the schedule shall be added scope of work the Contractor shall incorporate into the CPM schedule without change of completion date(s).

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD **RFP #XXXX** – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all submittals required in specific Specifications Sections in strict accordance with the procedures described below.
 - 02 All submittals shall be processed using the Architect's project management software – Newforma via Info Exchange.
- C. Related Work:
 - 01 Section 01 31 00 – Project Management Software
 - 02 All Division 2 through Division 32 Specification Sections.

1.2 PROJECT MANAGEMENT SOFTWARE

- A. All submittals shall be submitted and processed using Tomball ISD/LAN project management software – Project Mates. The successful proposer will be required to obtain a license for their own copy and/or copies of the software Package.

1.3 QUALITY ASSURANCE

- A. It is the sole responsibility of the Contractor / sub-contractor / material supplier to provide materials and Work that conforms to the requirements of the Contract Documents.
- B. The function of the submittal process is to provide the Contractor / sub-contractor / material supplier additional review / quality control of the materials / work proposed to be furnished for the Work.
- C. Prior to delivery to the Architect or Consultant, each submittal shall be thoroughly reviewed by the party / sub-contractor generating the submittal, as well as the General Contractor.
 - 01 Each reviewer shall document their review by affixing a stamp and signature, or a signed review cover sheet to each submittal. General Contractor sign-off for the submittal originator is not acceptable.
 - 02 All corrections shall be clearly noted.
 - 03 The Contractor shall determine whether the submittals are suitable to forward to the Architect / Consultant or return to the originator for revisions and re-submittal.
 - 04 Submittals which do not display (at least) two prior, separate reviews (submitter and General Contractor) shall be rejected and returned to the General Contractor.

- D. The Architect's / Consultant's review of submittals is only for review of the general conformance with the design concept of the project and general compliance with the information given in the Contract Documents.
- 01 The Architect's / Consultant's review of submittals shall NOT be construed as approval of the products, assemblies or Work being submitted, unless specifically stated as such.
 - 02 The Architect / Consultant shall not field verify any information requested on the submittal. That is the responsibility of the Contractor.
- E. Submit only what is proposed to be furnished. Where cut-sheets, etc. also contain information on items not to be furnished, clearly indicate / identify / separate the specific items proposed to be furnished from those which are not proposed to be furnished.
- 01 Where no such indication is made, it shall be understood the submittal is presenting options to be selected by the Architect / Consultant at no additional cost to the Owner.
- F. Submittals shall be rejected by the Architect / Consultant for any of the following:
- 01 Lack of required review stamps / cover sheets.
 - 02 Apparent / obvious lack of review by the General Contractor or original provider / subcontractor.
 - 03 An inordinate amount of revisions already noted by the General Contractor / sub-contractor.
 - 04 Incomplete or missing information.
 - 05 Inclusion of other items not proposed to be furnished.
- G. The Contract Documents in electronic format may be made available to the Contractor / sub-contractor for their use, provided the users execute a release form to the Architect / Consultant. Refer to **Section AI** for applicable forms to be executed and returned the relative party (Architect / Consultant) prior to release of Contract Documents in electronic format.
- H. All submittals shall be submitted with a cover sheet containing the following information:
- 01 Contractor's submittals number
 - 02 Date of submission and dates of any previous submissions
 - 03 Project title and Architect's project number
 - 04 Relative Specification Section number
 - 05 Names of Contractor, subcontractor, supplier, and / or manufacturer.
 - 06 Signed and dated review stamp or comment sheet from the party / sub-contractor generating the submittal
 - 07 Signed and dated review stamp or comment sheet from the General Contractor
- I. For any particular submittal, submit all written, standard format information as a single submittal; including the following as applicable to the submittal:
- 01 Product Data
 - 02 Installation Instructions
 - 03 Maintenance Instructions
 - 04 Certificates
 - 05 Sample Warranties
- J. For any particular submittal, submit all required Shop Drawings as a single submittal.
- K. For any particular submittal, submit all required product samples as a single submittal.

1.4 ELECTRONIC DELIVERY

- A. Electronic delivery of paper submittals in PDF format is required.
 - 01 Coordinate with the Architect for electronic or hard-copy delivery of full-size Shop Drawings submittals prior to submission.
 - 02 Provide a single, electronic copy of submittals with all previous review comments / mark-ups the Architect's project management software – Newforma via Info Exchange.
 - 03 Submittals shall be returned electronically to the General Contractor along with review comment sheets and / or mark-ups.
 - 04 The Contractor shall be required to print and distribute completed submittals to sub-contractors.
- B. Electronic submittals in PDF format shall be made in the same format (size) of the actual submittal (i.e. 8-1/2x11, 11x17, 24x36, and / or 30x42).
- C. The following are exceptions to the above and shall be submitted in electronic and hard copy:
 - 01 Steel Shop Drawings: to be submitted on full size, scalable sheets. Submit the number to be returned plus three (3) copies to be retained by the Architect and consultant.
 - 02 Bound MEP manuals / submittals in excess of twenty-five (25) pages. Submit the number to be returned plus three (3) copies to be retained by the Architect and Consultant.
- D. Owner's Record Set of Submittals:
 - 01 The Contractor shall maintain a separate set of all final submittals to be delivered to the Owner at project close-out.
 - 02 Submittals shall be organized, in order, by Specification Section.

1.5 SAMPLE DELIVERY

- A. Samples:
 - 01 Prior to submitting actual samples, deliver all electronic document submittals to the Architect.
 - 02 Submitted samples shall be the actual material(s) proposed to be furnished.
 - 03 Colors samples on paper or electronic format shall not be acceptable.
- B. Unless otherwise agreed to by the Architect, all sample submittals shall be delivered directly to the Architect's office.

1.6 SUBMITTAL NUMBERING AND NAMING

- A. Each submittal shall contain an identification number and specific written title.
 - 01 Submittals numbers should have a two (2) digit suffix based on Specification Section. (i.e. 04 20 00-01)
 - 02 Re-submittal numbers shall have an additional two (2) digit suffix based on Specification Section. (i.e. 04 20 00-01-01 or 04 20 00-01r01 per individual project settings.)
 - 03 Any additional GC submittal ID could be entered when sending the submittal to the Architect in the Sender ID field.
 - 04 Indicate the correct submittal number and description on the cover sheet.

- B. Each submittal shall contain a specific written title identifying the content of the submittal.
- 01 Documentation Submittal Package:
 - a. Product Data
 - b. Installation Instructions
 - c. Maintenance Instructions
 - d. Certificates
 - e. Sample Warranties
 - 02 Shop Drawings Submittal Package:
 - a. Shop Drawings
 - b. Engineering Calculations
 - 03 Samples Submittal Package:
 - a. Physical Samples (To be stored on site)
 - 04 O&M Manual Submittal Package (Prior to Substantial Completion):
 - a. Review Copy: Hard-copy in 3-ring binder.
 - b. Final Copy: Hard-copy in 3-ring binder and electronic copy on flash drive. Verify quantity with Architect.
- C. Failure to comply with the all quality assurance requirements may result in immediate rejection of the submittal without review. In such circumstances, no additional time shall be granted to the Contractor for resultant delays.

PART 2 - PRODUCTS

2.1 DOCUMENTATION SUBMITTAL

- A. Manufacturer's Product Data: Submit manufacturer's complete printed data on each product; including, but not necessarily limited to product cut-sheets, specifications, quality references, MSDS sheets, and general information, as necessary to demonstrate compliance with all specified requirements.
- B. Manufacturer's Installation Instructions:
- 01 Submit manufacturer's installation instructions, including all requirements as they specifically relate to the Work required in this Contract.
 - 02 Submission of generic details that do not depict actual conditions of the project shall be rejected.
- C. Manufacturer's Maintenance Instructions: Manufacturer's printed maintenance detailing information for proper care and maintenance of the product or assembly.
- D. Manufacturer's Test Reports and Certifications: Where applicable, submit test reports and certifications demonstrating compliance with the referenced standards and requirements.
- E. Warranties in Excess of one (1) Year: Submit sample copy of proposed warranties to be issued and executed for contract close-out.

2.2 SHOP DRAWING SUBMITTAL

- A. Shop Drawings shall be submitted with sufficient detail to fully describe the Work included. Partial sets, if submitted without prior approval from the Architect, shall be subject to rejection and / or holding until subsequent shop drawings are submitted.

- B. Details included in Shop Drawings shall depict actual project conditions related to the assembly. Details depicting generic substrates or interfacing work shall be subject to rejection.
- C. All dimensions indicated on the Drawings are based on the specific models and manufacturers of products, equipment, fixtures and miscellaneous items specified or used as a design basis.
 - 01 If the Contractor uses an approved product by another listed manufacturer which is different than the specific model and manufacturer listed in these Specifications, the Contractor shall be solely responsible for the coordination of any dimensional changes required, including structural, relocation of walls, equipment, fixtures, ceilings and miscellaneous items – all subject to approval by the Architect.
 - 02 When dimensional changes are required in these situations, the Contractor shall submit a proposed Modification Drawing to the Architect for approval prior to proceeding with the Work. All causes and effects of the dimensional change shall be indicated on the Contractor's Drawing submittal.
- D. Where required in individual Specification Sections, provide engineering calculations clearly demonstrating the proposed materials, products and / or assemblies meet or exceed the stated design criteria.
 - 01 Where required by individual Specification Sections, calculations shall be sealed and signed by a Texas Registered Engineer of appropriate discipline (structural, MEP, etc.) pertinent to the required calculations.

2.3 SAMPLE SUBMITTAL

- A. Finish Samples: Submit full range of manufacturer's standard colors, textures, and patterns for Architect's selection.
 - 01 Prior to submission of samples, provide all relative documentation submittals to the Architect.
 - 02 At Architect's option sample submittals may be waived if Architect already has samples of proposed materials in the Interiors Library. Coordinate with Architect as required.
- B. Selection of finishes from paper or digital representations shall not be accepted. Samples requiring selection of a color, pattern or similar finish shall be submitted in one of the following methods:
 - 01 Whenever possible, submit actual material product samples (i.e. carpet, aluminum, glass, plastic laminate, sealants, etc.)
 - 02 Paint colors for pre-finished materials shall be submitted on actual samples of substrate materials (i.e. paint on sheet metal).
 - 03 Manufacturer's standard color wheels or similar shall be acceptable for paint selections for field painted items; however, the Architect may require to see / approve an actual application of paint on the intended material in the field.
- C. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.
- D. Submittals shall contain:
 - 01 Date of submission and dates of any previous submissions
 - 02 Project title and number
 - 03 Contract identification
 - 04 Names of Contractor, Supplier, Manufacturer
 - 05 Identification of sample, with specification section number

2.4 MOCK-UPS

- A. Provide mock-ups of actual products or assemblies where required in individual Specifications.
 - 01 Coordinate with other trades as required for mock-ups incorporating work from multiple trades.
- B. Mock-ups shall specifically represent what is proposed to be furnished in the actual, installed work.
- C. Once approved, all mock-ups shall be retained by the Architect and / or be left assembled at the job site until all such Work is completed at the project; and shall become the basis for comparing / accepting actual installed work.

PART 3 – EXECUTION

3.1 PREPARATION

- A. The Contractor shall formulate and provide a Preliminary Submittal Log to the Architect within twenty (20) days after execution of the Owner – Contractor Agreement, to allow for proper coordination and scheduling reviews.
- B. Preliminary Submittal Log: Prior to submission of any submittals, the Contractor shall furnish a in Excel format a complete spreadsheet of all submittals proposed to be furnished.
 - 01 The list should be comprehensive and aligned with the CSI specification number identified in the Project Manual.
 - 02 Additionally, include the anticipated schedule for the submission of each submittal.
 - 03 The submitted spreadsheet shall include the following Columns:
 - a. CSI Specification Number
 - b. (Optional) Contractor's Submittal Number (Sender ID)
 - c. Submittal Title/Subject
 - d. Submittal Description (Shop Dwgs, Product Data, Sample)
 - e. Date Submittal is expected to be received
 - f. Contact's name sending the submittal
- C. Upon receipt, the Architect shall review the preliminary submittal log and coordinate with the Contractor on any revisions.

3.2 SUBMITTAL COORDINATION

- A. Where ever possible, individual submittals should consolidate all required submittal information (i.e. product data, installation instructions, maintenance instructions, etc.)
 - 01 Shop drawings, samples and similar items may be submitted separately; however, they should be submitted at the same time, unless otherwise agreed upon by the Architect.
 - 02 The submittals for a particular specification or assembly shall not be considered complete and reviewable until all items / information required to be submitted have been received by the Architect.
 - a. Exceptions: O&M manuals, final warranties and similar end of construction items.
 - 03 Review of piecemealed submittals shall be at the Architect's sole discretion; and will only be considered for extraordinary conditions.

- B. Group or package submittals relative to the assembly which are dependent upon each other for a thorough review (i.e. doors, frames and hardware).
 - 01 Time periods for proper and complete submittal reviews which are contingent on or must be coordinated with separate but related submittals shall begin at the time of the Architect's / Consultant's receipt of the last required submittal. Contractors are urged to group submittals appropriately in this regard.
- C. Selection of finish samples will begin only after receipt of all finish selection samples, including exterior and interior finishes. Finishes and samples shall NOT be selected piecemeal.
- D. No extensions of Contractor Time or Cost shall be allowed due to lack of submittal coordination by the Contractor.

3.3 SCHEDULE

- A. The Contractor shall schedule to complete the submittal process within a maximum of one hundred twenty (120) days after execution of the Owner – Contractor Agreement.
- B. In formulating the submittal schedule, the Contractor shall allow the following review periods:
 - 01 Architect – allow fourteen (14) calendar days response time, after Architect's receipt, for all submittals made to and reviewed by the Architect.
 - 02 Architect's Consultant – Allow twenty (20) calendar days response time, after Consultant's receipt, for all submittals which must be reviewed by Architect's Consultants.
 - 03 All Consultant submittals shall be returned to the Architect for delivery to the Contractor.

3.4 PROCEDURES

- A. All submittal packages shall be transmitted / uploaded to the project management software.
- B. Transmit each submittal package with coversheet containing the following information:
 - 01 Project name
 - 02 Contractor name
 - 03 Subcontractor and / or major supplier.
 - 04 Submittal number.
 - 05 Specification Section number and name.
 - 06 Type of submittal package (i.e. documentation, Shop Drawings, etc.)
 - 07 Subcontractor review / approval certification or stamp.
 - 08 Contractor review / approval certification or stamp.
- C. Sub-Contractor's / Supplier's Conveyance to the General Contractor: Each sub-contractor / supplier is required to review their own submittal; and additionally, apply a signed and dated stamp certifying review, verification of products, field dimensions, adjacent construction work and coordination of information is in accordance with the requirements of the Work and Contract Documents.
- D. Contractor's Conveyance to the Architect / Consultant: The Contractor is required to thoroughly review and check all submittals received from subcontractors / suppliers; and additionally apply a signed and dated stamp certifying a thorough review.
 - 01 The submittal shall contain Contractor review comments and / or mark-ups as applicable.

- E. Submittals forwarded to the Architect / Consultant without the Subcontractor's and Contractor's review stamp shall be automatically rejected without review and returned to the Contractor.
- F. If, in the opinion of the Architect / Consultant, the submittal indicates a lack of review or the Contractor's / sub-contractor's review is incomplete, the submittal will be returned, unchecked, to the General Contractor for correction of any / all deficiencies for subsequent re-submittal.
- G. Revise and resubmit submittal as required; clearly identify all changes made since previous submittal.
 - 01 Submittals that are required to be resubmitted more than one (1) time shall be subject to additional service charges for the Architect's / Consultant's repeated review(s) as outlined in **Section 01 45 23.13 – Observation Procedures**.
- H. After review, distribute copies to all concerned parties.
- I. The Contractor shall perform no portion of the Work for which the Contract Documents require submittals until the respective submittal has been reviewed by the Architect / Consultant without request for re-submittal.

3.5 CLAIM NOTIFICATION

- A. If the submitter or Contractor issues submittals for which an additional cost is anticipated, the submittal must clearly indicate such cost including all supporting information.
 - 01 Lack of accompanying cost information known at the time of the original submittals shall be grounds for disallowance of such cost.
- B. Upon return of submittal(s) to the originator of the submittal(s), the submitter shall thoroughly review all mark-ups and / or comments prior to proceeding with the Work.
- C. Based on the mark-ups and / or comments returned, the submitter shall have fifteen (15) calendar days to submit a claim notification for additional costs the submitter may feel is warranted by the mark-ups / and or comments of the Architect or Consultant.
 - 01 The fifteen (15) calendar day period shall commence upon Contractor's receipt of the submittal from the Architect.
- D. In the absence of any claim notification within the specified time period, it shall be agreed the submitter shall provide the Work in accordance with the final, reviewed submittal at no additional cost.
- E. In the event a claim notification is submitted to the General Contractor / Construction Manager, the submittal process shall not be complete until all such claim notifications have been fully resolved.

END OF SECTION

SECTION 01 35 23

TOMBALL INDEPENDENT SCHOOL DISTRICT OWNER SITE RULES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. The Contractor shall adhere to all Owner Site Rules at all times during the Work.
01 Failure to adhere to Owner Site Rules may result in expulsion of personnel violating rules and / or fines as established on a district-wide basis by the Owner.
- C. Owner site rules are in addition to all other regulatory rules to be adhered to by the Contractor.

1.2 OWNER SITE RULES

- A. No foul language or spitting on floor.
- B. No tobacco products on school property. On new construction projects, tobacco products are prohibited after air conditioning systems are initially activated.
- C. The possession or use of alcohol or illegal drugs is strictly prohibited.
- D. No tank tops – workers must be fully clothed.
- E. No workers with a history of felony convictions or warrants.
- F. No parking on grass, under shade trees, sidewalks or non-vehicular paved areas.
- G. Entry into any occupied Tomball ISD facility must be cleared in advance with the District Facilities Department and at the campus level prior to scheduled entry. Upon arrival at the campus, all entrants must check in at the office for entry processing (i.e. Raptor system) and sign in and out at time of arrival and departure.
- H. Contractor's employees, subcontractors and their agents and employees working on any District facility must wear picture identification with the company name. Any exceptions must be approved in advance with the designated District Representative.
- I. Keep the premises free from accumulation of waste, materials or rubbish caused by the work under this Contract at each site. Boxes must be broken down prior to removal from the building. Upon completion of the Work, and prior to the final inspection, have the premises in a neat and clean condition.

- J. Take all precautions necessary for the safety of, and provide protection to prevent damage, injury or loss to:
 - 01 All employees on the project and all other persons who may be affected thereby.
 - 02 All the work and all materials to be incorporated therein, whether in storage on or off the site.
 - 03 All property at the site and adjacent thereto including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and any other school property.
- K. A competent supervisor who understands the full scope of the Work shall be on site at all times.
- L. School administrative services shall at all times have priority over the Contractor's use / service / etc.
- M. Any work that may interfere with school activities must be authorized in advance through administrative channels. A management plan will be devised to minimize the effect of the interference.
- N. The Contractor shall be responsible to Tomball ISD for acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the Work under the Contract.
- O. No work within the confines of a secured building will be allowed without a least one District custodian present. The Contractor must pay the Tomball ISD Custodial Department in advance for the cost of adding a custodian to a building for after-hours work.
- P. Doors must not be propped open when working after-hours.
- Q. Only the designated District representative who let the Contract for services will be authorized to sign documents that require releases or acceptance of Work by the District.

END OF SECTION

SECTION 01 36 13

CUTTING AND PATCHING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide cutting and patching of existing work as required for the proper installation of new work, including proper interface with existing work.
 - 02 Cutting and patching includes, but is not limited to:
 - a. Gypsum board assemblies
 - b. Finish flooring
 - c. Wall finishes
 - d. Doors and frames
 - e. Ceiling assemblies
- C. Related Work:
 - 01 Section 01 36 16 – Remodeling and Alteration Procedures
 - 02 Section 02 41 16.13 – Building Demolition
 - 03 Section 02 41 19 – Selective Demolition

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Submit written request in advance of cutting or alteration which affects:
 - 01 Structural integrity of any element of the Project
 - 02 Integrity of weather-exposed or moisture-resistant element
 - 03 Efficiency, maintenance, or safety of any operational element
 - 04 Visual qualities of sight-exposed elements
 - 05 Work of Owner or separate Contractor
 - 06 Any work in or around any known or potential area in which asbestos or lead based products exist.
- C. Procedural Proposal for Cutting and Patching: Where prior consent for cutting and patching is required, submit proposed procedures for this Work well in advance of the time work will be performed, and request consent to proceed. Include the following information, as applicable, in the submittal:
 - 01 Describe the nature of the Work and how it is to be performed, indicating why cutting and patching cannot be avoided. Describe anticipated results of the Work in terms of changes to and effects upon existing work, including structural, operational and visual changes, as well as other significant elements.
 - 02 List products to be used and firms that will perform Work.
 - 03 Give dates when work is expected to be performed.
 - 04 List utilities that will be disturbed or otherwise be affected by Work, including those that will be relocated and those that will be temporarily out of service.

- Indicate how long utility services will be disrupted.
- 05 Where cutting and patching of structural work involves the additional reinforcement, submit details and engineering calculations to show how that reinforcement is integrated with the original structure to satisfy requirements.
 - 06 Consent by the Architect to proceed with cutting and patching work does not waive the Architect's right to later require complete removal and replacement of work found to be cut and patched in an unsatisfactory manner.

1.3 DESCRIPTION OF REQUIREMENTS

- A. Definition: "Cutting and patching" includes cutting into existing construction to provide for the installation or performance of other Work and subsequent fitting, and patching required to restore surfaces to their original condition.
 - 01 Cutting and patching is performed for coordination of the Work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed, to remove and replace work not conforming to Contract requirements, or for other similar purposes.
 - 02 Cutting and patching performed during the manufacture of products, or during the initial fabrication, erection of installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be cutting and patching.
- B. Refer to other Sections of these Specifications for specific cutting and patching requirements, and limitations applicable to individual units or work.
 - 01 Unless otherwise specified, requirements of this Section apply to Mechanical and Electrical Work. Refer to Divisions, 21, 22, 23, 26, 27 and 28 Sections for additional requirements and limitations on cutting and patching of Mechanical and Electrical Work.

1.4 RELATED REQUIREMENTS

- A. Individual Specifications Sections:
 - 01 Cutting and patching incidental to Work of this Section.
 - 02 Advance notification to other trades of openings required in work of those trades.
 - 03 Limitations on cutting structural members.

1.5 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural work in a manner that would result in a reduction of load-carrying capacity or load-deflection ratio.
- B. Before cutting and patching the following categories of Work, submit a written request and obtain the Architect's consent to proceed with cutting and patching, as described in the procedural proposal for cutting and patching.
 - 01 Structural steel
 - 02 Miscellaneous structural metals, including lintels, equipment supports, stair systems and similar categories of Work
 - 03 Structural concrete
 - 04 Foundation construction
 - 05 Shoring assemblies
 - 06 Bearing and retaining walls
 - 07 Structural decking
 - 08 Exterior wall construction
 - 09 Piping, ductwork, vessels and equipment

- C. Operational and Safety Limitations: Do not cut and patch operational elements or safety related components in a manner that would result in a reduction of their capacity, to perform in the manner intended, including energy performances, or that would result in increased maintenance, or decreased operational life, or decreasing safety. Before cutting and patching the following elements of Work, and similar work elements where directed, obtain the Architect's consent to proceed with cutting and patching.
- 01 Shoring, bracing, and sheeting
 - 02 Primary operational systems and equipment
 - 03 Water/moisture vapor/air/smoke barriers, membranes and flashings
 - 04 Noise and vibration control elements and systems
 - 05 Control, communication, conveying, and electrical wiring systems
 - 06 Special construction, as specified by Division 13 sections
- D. Visual Requirements: Do not cut and patch work exposed on the building's exterior or in its occupied spaces, in a manner that would, in the Architect's opinion, result in lessening the building's aesthetic qualities. Do not cut and patch work in a manner that would result in substantial visual evidence of cut and patch work. Remove and replace work judged by the Architect to be cut or patched in a visually unsatisfactory manner. If possible, retain the original installer or fabricator, or another recognized, experienced and specialized firm to cut and patch the following categories of exposed work:
- 01 Architectural concrete finishes
 - 02 Brick and concrete unit masonry
 - 03 Roofing
 - 04 Preformed metal panels
 - 05 Window system
 - 06 Gypsum or cement plaster
 - 07 Acoustical ceilings
 - 08 Carpeting
 - 09 Wall covering
 - 10 HVAC enclosure, cabinets or covers

1.6 PAYMENT FOR COSTS

- A. Cost for work necessary to accommodate installation of new work shall be borne by the Contractor or subcontractor responsible for installing new work.
- B. Costs caused by ill-timed or defective work, or work not conforming to Contract Documents, including costs for additional services of the Architect and other Design Consultants shall be borne by the party responsible in the judgment of Architect, for ill-timed, rejected or non-conforming work.
- C. Costs for work performed on instruction of Owner, other than the correction of defective or non-conforming work shall be responsibility of the Owner, who shall issue an appropriate Change Order for the increase in costs.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Except as otherwise indicated, or as directed by the Architect, use materials for cutting and patching that are identical to existing materials. If identical materials are not available or cannot be used, use materials that match existing adjacent surfaces to the fullest extent possible, with regard to visual effect. Use materials for cutting and patching that will result in equal-or-better performance characteristics.

PART 3 - EXECUTION

3.1 GENERAL

- A. Execute cutting, fitting, and patching to complete work, and to:
 - 01 Fit several parts together which will integrate with other work.
 - 02 Uncover work to install ill-timed work.
 - 03 Remove and replace defective and non-conforming work.
 - 04 Remove samples of installed work for testing.
 - 05 Provide openings in elements of work for penetrations of mechanical and electrical work.
 - 06 Fill and refinish existing holes and damaged areas.

3.2 INSPECTION

- A. Before cutting, examine the surface to be cut and patched and the conditions under which the work is to be performed. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding with the work.

3.3 PREPARATION

- A. To prevent failure, provide temporary support of work to be cut.
- B. Protect other work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for that part of the project that may be exposed during cutting and patching operations.
- C. Take precautions not to cut existing pipe, conduit or duct serving the building, but scheduled to be relocated until provisions have been made to bypass them.

3.4 PERFORMANCE

- A. Employ skilled workmen to perform cutting and patching work. Except as otherwise indicated or as approved by the Architect, proceed with cutting and patching at the earliest feasible time and complete work without delay.
- B. Cut the work using methods that are least likely to damage work to be retained or adjoining work. Where possible, review the proposed procedures with the original installer; comply with original installer's recommendations.
 - 01 In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chipping. Cut through concrete and masonry using a cutting machine such as a carborundum saw or core drill to ensure a neat hole. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces. Temporarily cover the opening when not in use.
 - 02 Comply with requirements of applicable Sections of Division 2 when cutting and patching, excavating, and backfilling.
 - 03 Bypass utility services such as pipe and conduit, before cutting, where such utility services are shown or required to be removed, relocated, or abandoned. Cut-off conduit and pipe in walls or partitions to be removed. After bypassing and cutting, cap, valve or plug, and seal tight the remaining portion of pipe and conduit to prevent entrance of moisture or other foreign matter.
- C. Patching: Patch with seams which are durable and as visible as possible. Comply with specified tolerances for the Work.
 - 01 Where feasible, inspect and test patched areas to demonstrate integrity of

- work.
- 02 Restore exposed finishes of patched areas, and where necessary, extend finish restoration into retained adjoining work in a manner which will eliminate evidence of patching and refinishing.
 - 03 Where removal of walls or partitions extend one finished area into another finished area, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. If necessary to achieve uniform color and appearance, remove the existing floor and wall coverings and replace with new materials.
 - 04 Where a patch occurs in a smooth painted surface, extend final paint coat over the entire unbroken surface containing the patch, after the patched area has received prime and base coat.
 - 05 Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.
- D. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
 - E. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated material, full thickness of the construction element.
 - F. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

3.5 CLEANING

- A. Thoroughly clean areas and spaces where work is performed or used as access to work. Completely remove paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finish is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01 36 16

REMODELING AND ALTERATION PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 This Section contains general provisions and requirements pertaining to all remodeling, removal and relocation work in the existing building(s), and becomes a part of each Section and Division performing remodeling, removal and relocation work for this Project, with the same force and effect as if written in full therein.
 - 02 Take all necessary precautions to keep unauthorized people out of the work areas.
 - 03 Secure all work areas from entry when Work is not in progress.
 - 04 Perform all remodeling, demolition, removal and relocation work in strict accordance with Owner's instructions and applicable Federal, State and local health and safety standards, codes and ordinances. Where conflicts occur, the more restrictive requirement shall govern.

1.1 EXISTING CONDITIONS

- A. Obvious existing conditions, installations and obstructions affecting the Work shall be taken into consideration as necessary.
 - 01 Work to be done is the same as though they were completely shown or described.
- B. Items of existing construction indicated to remain upon completion of the Contract, but which require removal to complete the Work, shall be carefully removed and replaced as required.
 - 01 The replaced work shall match its condition at the start of the Work, unless otherwise required.
- C. Visit the site and inspect all existing conditions, including access to the site, the nature of structures, objects and materials to be encountered, and all other facts concerning or affecting the Work.
 - 01 Information on the Drawings showing existing conditions does not constitute a guarantee that other items may not be found or encountered.
- D. Utilities: Do not interrupt existing utilities serving occupied or facilities in use.
 - 01 Provide a minimum two (2) week notice to Architect and Owner for any required interruption of utilities or services required to complete the Work.
 - 02 Utility or service interruptions must be approved by the Owner prior to proceeding.
 - 03 Utility or service interruptions shall be limited in duration as much as possible, and as agreed upon by Owner.

- 04 When required, provide temporary services during interruptions to existing utilities.
- E. Stop Work and notify Architect and Owner immediately if any hazardous materials are encountered.

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

- A. The Owner reserves the right of first refusal on all salvaged items.
 - 01 Remove remaining items from the site as work progresses.
 - 02 Storage or sale of items on site is not permitted.
 - 03 Burning of removed materials on site is not permitted.
- B. Store salvaged items in a dry, secure place on site.
- C. Salvaged items not required for use in repair of existing work shall remain the property of the Owner.
- D. Do not incorporate salvaged or used material in new construction, except with permission of the Architect.

2.2 PRODUCTS FOR PATCHING, EXTENDING AND MATCHING

- A. Contract Documents do not define products or standards of workmanship present in existing construction.
 - 01 Determine products by inspection and by use of the existing construction. Provide same or similar quality products or types of construction such as the existing structure, where needed to patch or extend existing work.
- B. If reasonably matched products are not obtainable, improve appearance by minor relocating some of the existing products, and grouping new ones in a pattern arranged by the Architect.
 - 01 Do not replace products scheduled for retaining because matching ones are not obtainable, except as directed by a Change Order.

PART 3 - EXECUTION

3.1 PROTECTION OF WORK TO REMAIN

- A. Protect existing work from damage by use of barricades, tarpaulins, temporary walls, plywood, planking, masking, or other suitable means and methods as approved by the Architect.
- B. If Work to remain in place is damaged, restore to original condition at no additional cost to the Owner.
- C. Concealed Conditions: If conditions cause changes in the Work from requirements of the Contract Documents, the Contract Sum, if warranted, will be adjusted in accordance with the General Conditions.

3.2 PROCEDURES

- A. Refinishing at Removed Work: Cut below the surface of substrate materials and patch over the area of removal with finish materials so removal is not apparent.
- B. Remove and replace existing ceilings, cut, patch, or replace existing walls, partitions and floors, as may be necessary for access to valves, piping, conduit and tubing by mechanical and electrical trades, as directed and approved by the Architect.
 - 01 Work involved shall be performed by the appropriate subcontractor, or by other properly qualified subcontractors.
- C. Patch and extend existing work using skilled mechanics who are capable of matching existing quality of workmanship.
 - 01 Quality of patched or extended work shall not be less than that specified for new work.
- D. Cutting:
 - 01 Concrete and Masonry: Saw cut as required for removal.
 - 02 Plaster: Cut back to sound plaster on straight lines, and back-bevel edges of remaining plaster. Trim and prepare existing lath for tie-in of new lath.
 - 03 Woodwork: Cut back to a joint or panel line. Undamaged removed materials may be reused.
 - 04 Resilient Tiles: Remove in whole units to natural breaking points or straight joint lines, with no damaged or defective existing tiles remaining where joining new construction.
 - 05 Salvaged Materials: Carefully remove to avoid damage, thoroughly clean and reinstall as indicated, or store as directed.
 - 06 Doors: Remove in such manner as to facilitate filling in of openings or installation of new work, as required by the Drawings.
 - 07 Structural Elements: Remove only as shown on the Structural Drawings. If not specifically shown, but removal is required, perform such removal or alteration only upon written approval of the Architect. Do not damage or alter any structural element of the existing building.
- E. Patching:
 - 01 Match existing work where possible; if unavailable, use salvage material for patching, and provide totally new material in areas where salvage has been removed. Consult with the Architect concerning locations for salvaging materials.
 - 02 Repairs or continuations of existing work shall be relatively imperceptible in the finished work when viewed under finished lighting conditions from a distance of 6 feet.
 - 03 Patching, Repairing, and Finishing of Existing Work: Perform in compliance with the applicable requirements of the Specification Section covering the Work to be performed and the requirement of this Section.
- F. Erect scaffolding as necessary to gain access to the various parts of the Work.
 - 01 Provide structurally sound, rigidly braced and properly constructed scaffolding, shoring and bracing as necessary to positively protect the affected elements and building, and to support the activities or workmen and loads.
 - 02 Design and construction of scaffolds and supports shall be in accordance with applicable safety regulations.
 - 03 Material used shall be adequate to support anticipated loads with a properly calculated margin of safety.
- G. Noise Producing Equipment: Minimize use of noise producing equipment.

- 01 Limit excessive noise to periods of vacancy or provide sound control.
- 02 Arrange schedules in advance with the Architect.

3.3 EXISTING FURNITURE AND EQUIPMENT

- A. Owner Salvaged Items: Personal items in areas subject to remodeling will be removed before construction in those areas commences.
- B. Furniture Items: Before remodeling commences, remove all furniture and equipment from each space, store items as necessary, and replace these items to the same locations after each remodeling phase is complete.

3.4 PAINTING AND FINISHING

- A. Preparation: Prepare patched areas as required for new work. Wash existing painted surfaces with neutral soap or detergent, thoroughly rinse, and sand when dry.
- B. Painting and Finishing: Conform to the applicable provisions of Section 09 91 00 – Painting and Re-Painting.
 - 01 Prepare bare areas and patches in existing painted surfaces with specified primer and intermediate coats, sanded smooth and flush with adjoining surfaces.

3.5 DISPOSAL OF DEBRIS

- A. Remove material, debris and rubbish resulting from work of this Section from the building and site as it accumulates. Keep all areas of work in “broom clean” condition as the Work progresses.
- B. At completion of renovation and remodeling work in each area, provide final cleaning and return space to a condition suitable for use by the Owner.

END OF SECTION

SECTION 01 42 13

ABBREVIATIONS AND ACRONYMS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 TYPICAL TRADE ORGANIZATION AND INDUSTRY ABBREVIATIONS

Acoustical Society of America	ASA
Adhesive & Sealant Council, Inc.	ASC
Air Conditioning & Refrigeration Institute	ARI
Aluminum Association	AA
American Association of State Highway Officials	AASHO
American Concrete Institute	ACI
American Council of Independent Laboratories	ACIL
American Hardboard Association	AHA
American Hot-Dip Galvanizers Association	AHGA
American Institute of Architects	AIA
American Institute of Steel Constructors	AISC
American Institute of Timber Construction	AITC
American Iron & Steel Institute	AISI
American National Standards Institute, Inc.	ANSI
American Plywood Association	PA
American Society for Testing & Material	ASTM
American Society of Civil Engineers	ASCE
American Society of Heating, Refrigeration and Air Conditioning Engineers	ASHRAE
American Society of Mechanical Engineers	ASME
American Subcontractors Association	ASA
American Woodworking Institute	AWI
American Welding Society	AWS
American Wood Preserver's Institute	ASPI
Architectural Aluminum Manufacturers Association	AAMA
Architectural Woodwork Institute	AWI
Asphalt Institute	AI
Associated General Contractors of America	AGC
Brick Institute of America	BIA
Building Research Institute	BRI
California Redwood Association	CRA
Chain Link Fence Manufacturers Institute	CLFM
Concrete Reinforcing Steel Institute	CRSI
Construction Specification Institute	CSI
Door and Hardware Institute	DHI
Facing Tile Institute	FTI
Federal Specifications	FS
Flat Glass Marketing Association	FGMA
Gypsum Association	GA
Hardwood Plywood Manufacturers Association	HPMA
International Conference of Building Officials	ICBO
Joint Sealer Manufacturers Association	JSMA
Maple Flooring Manufacturers Association	MFMA
Metal Lath Association	MLA

National Association of Architectural Metal Manufacturers	NAAMM
National Association of Mirror Manufacturers	NAMM
National Bureau of Lathing & Plastering	NBLP
National Clay Pipe Institute	NCPI
National Concrete Masonry Association	NCMA
National Electrical Manufacturers Association	NEMA
National Environmental Systems Contractors	NESC
National Fire Protection Association	NFPA
National Forest Products Association	NFPA
National Hardware Lumber Association	NHLA
National Ornamental Metal Manufacturers Association	NOMMA
National Paint, Varnish and Lacquer Association	NPVLA
National Ready Mixed Concrete Association	NRMCA
National Roofing Contractors Association	NRCA
National Society of Professional Engineers	NSPE
National Woodwork Manufacturers Association, Inc.	NWMA
Painting and Decorating Contractors of America	PDCA
Perlite Institute, Inc.	PI
Portland Cement Association	PCA
Resilient Floor Covering Institute	RFCI
Rubber and Vinyl Floor Council	RVFC
Southern Building Code Congress	SBC
Southern Forest Products Association	SFPA
Southern Hardwood Lumber Manufacturing Association	SHLMA
Steel Deck Institute	SDI
Steel Door Institute	SDI
Steel Joist Institute	SJI
Steel Structures Painting Council	SSPC
Texas Accessibility Standards	TAS
Tile Council of America, Inc.	TCA
Underwriter's Laboratories, Inc.	UL
Venetian Blind Institute	VBI
Vinyl Fabrics Institute	VFI
West Coast Lumber Inspection Bureau	WCLIB
Western Red Cedar Lumber Association	WRCLA
Western Wood Products Association	WWPA

1.2 TYPICAL CONTRACT DOCUMENT ABBREVIATIONS

Acoustical	ACOUST	Diameter	DIA
Air Handling Unit	AHU	Dimension(s)	DIM or DIMS
Alternate	ALT	Door	DR
		Each	EA
Aluminum	ALUM	Electrical	ELECT
Bottom	BOT	Elevation	ELEV
Building	BLDG	Equal	EQ
Carpet	CPT	Existing	EX or EXIST
Cast-In-Place	CIP	Expansion Joint	EJ or EXP JT
Centerline	CL	Exterior	EXT
Ceramic Tile	CT or CER TILE	Finish or Finished	FIN
Classroom	CR	Finish Floor	FF or FIN FL
Concrete	CONC	Fixture	FIXT
Concrete Masonry Unit	CMU	Floor	FL
Construction Manager	CM	Floor Drain	FL
Continuous	CONT	Flow Line	FL
Corridor	CORR	Frame	FR

Galvanized	GALV
Gauge	GA
General Contractor	GC
Grade	GR
Gypsum Board	GB or GYP BD
Handicap	HC
Hardware	HW
Height	HT
Hollow Metal	HM
Hot Dipped Galvanized	HD GALV
Inside Diameter	ID
Insulation	INSUL
Interior	INT
Lavatory	LAV
Light	LT
Manhole	MH
Manufacturer	MFGR or MFR
Marker Bboard	MB
Masonry	MAS
Material	MATL
Match Existing	ME
Maximum	MAX
Metal	MTL
Minimum	MIN
Not in Contract / Work by Others	NIC
Office	OFF
On Center	OC
Outside Diameter	OD
Overflow Drain	OD
Paint	P or PT
Plastic Laminate	PL or PLAST LAM
Radius	RAD
Reflected Ceiling Plan	RCP
Reinforcing	REINF
Reinforced Concrete Pipe	RCP
Required	REQ
Resilient Tile	RT
Restroom	RR
Roof Drain	RD
Room	RM
Rough Opening	RO
Sanitary Sewer	SAN SWR
Schedule	SCHED
Sidewalk	SW
Similar	SIM
Sink	SK
Solid Core Plastic Laminate	SCPL
Space	SP
Stainless Steel	SS
Storage	STOR
Stormsewer	STM SWR
Suspended Acoustical Ceiling	SAC
Tack Board	TB
Temporary Bench Mark	TBM
Thick	THK
Top of Curb	TC or TOC

Top of Grate	TG or TOG
Top of Steel	TS or TOS
Treated	TRTD
Typical	TYP
Urinal	URIN
Vinyl Composition Tile	VCT
Vinyl Wall Covering	VWC
Water Closet	WC
Wood	WD

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTION SERVICES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 The Contractor shall allow in his proposal the coordination and supervision of tests to be performed by an independent laboratory selected by the Owner.
 - 02 All testing laboratory services shall be provided and paid for by the Owner outside of this Contract.
 - 03 A testing lab shall be selected by the Owner, and the Contractor shall be notified as soon as possible.
 - 04 The Contractor shall cooperate with the testing laboratory in all matters pertaining to the Work. The Owner retains the option to add to or delete any or all testing specified herein.
- C. Related Work:
 - 01 Section 01 31 29 – Notification of Architect Requirements
 - 02 Section 01 45 23.13 – Observation Procedures
 - 03 Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals, or public authorities.
 - 04 Respective Sections of Specifications: Certification of products.
 - 05 Each Specification Section Listed: Laboratory test required and standards for testing.
- D. Testing laboratory inspection, sampling and testing is required for:
 - 01 Division 03 – Concrete
 - 02 Section 04 20 00 – Unit Masonry
 - 03 Section 31 20 00 – Earth Moving
 - 04 Section 31 23 33 – Trenching and Backfilling
 - 05 Section 31 32 13.19 – Lime Soil Stabilization
 - 06 Electrical, plumbing and mechanical tests required in relative Sections.
 - 07 As requested by the Owner or Architect

1.1 AUTHORITIES AND DUTIES OF THE TESTING LABORATORY

- A. The testing laboratory shall provide testing services under a separate agreement with the Owner or Architect, who shall be responsible for the costs of initial testing – pass or fail.
 - 01 The Contractor shall be responsible for costs of all re-tests required to achieve passing results.
 - 02 The Contractor shall be responsible for charges of the testing lab for expenses incurred for cancelled and / or mis-scheduled testing requests.
 - 03 The testing lab shall invoice Contractor direct for all re-tests of failed initial tests; and send copies of the invoices to the Architect and Owner for record.

- 04 The testing lab and Contractor shall be responsible to negotiate and execute a separate agreement if required by the testing lab for charges described above.
- B. The laboratory is not authorized to revoke, alter, relax, enlarge, or release any requirement of the Specifications, or to approve or accept any portion of the Work.
 - 01 When it appears that the material furnished or work performed by the Contractor fails to fulfill Specification requirements, the testing laboratory shall promptly notify the Contractor, Architect and Owner of work being tested of such deficiencies.
- C. The laboratory shall promptly distribute copies of the laboratory test and inspection reports. Standard distribution shall include copies of all reports to the Owner, Architect, and Contractor.
 - 01 The Structural Engineer, Civil Engineer, MEP Engineer, concrete supplier, and any outside Consultants shall receive copies of the testing results regarding their particular phase of the project.
 - 02 Electronic distribution of test reports / results is mandatory.
- D. The testing lab is required to furnish a report of the status of testing performed as it relates to anticipated expenses described in the Agreement with the testing lab. Reports shall be furnished at most bi-monthly to the Owner and Architect.
 - 01 Report information shall include verification that Owner paid testing progress corresponds with anticipated expenses.
 - 02 The testing lab shall be required to notify the Architect and Owner immediately if / when the testing lab anticipates exceeding the lump sum fee agreed to by the Owner.
 - 03 Such notification must occur prior to expensing 75% of the testing lab fee.

1.2 TESTING LABORATORY CONTRACTUAL RELATIONSHIPS

- A. The Owner shall contract with the Testing Laboratory outside the Owner-Contractor Agreement.
- B. The Owner shall pay for the initial laboratory services / tests – pass or fail.
- C. In the case of a failed test that does not meet the specified requirements, the Contractor shall be responsible for payment directly to the Testing Laboratory for all services / re-testing required to achieve a passing result.
 - 01 The Owner shall not be invoiced for services or re-testing associated with failed initial tests.
- D. The Owner shall not be responsible for Contractor's mismanagement or mis-scheduling of the Testing Laboratory that results in cost to the Testing Laboratory that do not result in Testing Laboratory performing its intended function (i.e. Contractor cancellation of Testing Laboratory services previously called for).
- E. The Testing Laboratory record and document all retesting of failed initial tests and charges due to the mismanagement or mis-scheduling of the Contractor.
- F. The Testing Laboratory is responsible for making separate arrangements with the Contractor for invoicing reimbursement of mismanaged services and re-testing associated with failed initial tests. Such expenses shall not be invoiced to the Owner.

1.3 TESTING LABORATORY GUIDELINES AND PROCEDURES

- A. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap (i.e., earthwork, foundation inspections, rebar

inspection, and concrete), when scheduled concurrently at the project site.

- B. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for any hours over eight hours spent at the job site on a single day, field testing services performed on a Saturday or Sunday, and any field services performed on a recognized holiday.
- C. Concrete design mixes will receive a cursory review with any discrepancies reported to the Architect.
- D. Nuclear density testing will be based on a daily rental rate for the actual testing equipment; compensation on a per test basis will not be considered.
- E. Report distribution shall include the Owner, Architect, Contractor, Civil Engineer, Structural Engineer, and others requesting or requiring review of the specific testing results.
- F. Job site trips solely for cylinder pick-up shall be minimized. Whenever possible, cylinder / specimen pick-up shall be conducted when a technician is scheduled to be on-site for other testing work.
- G. Structural steel inspections shall include a plant visit reviewing shop fabrication, welding and an overall review of the shop fabrication quality control standards. Structural steel field inspection shall include a 100% visual review of all field fillet welds and initial frequency of 25% ultrasonic testing of full field penetration welds. There shall be 100% visual review of all bolted connections, and a minimum of two (2) bolts tested at every bolted connection.
- H. The Contractor shall bear the responsibility of scheduling all testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services. Cancellations and/or failed tests will be reimbursable to the Owner by the responsible party for the cancellation or failure of a test or service.

1.4 REFERENCES

- A. Earthwork:
 - 01 ASTM D4318-10 – Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 02 ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 - 03 ASTM D6938-10 – Standard Test Method for In-Place Density and Water Content of Soil-Aggregate by Nuclear Method (shallow Depth)
 - 04 AASHTO T89 – Determining the Liquid Limit of Soils
 - 05 AASHTO T90 – Determining the Plastic Limit and Plasticity Index of Soils
 - 06 AASHTO T99 – Moisture-Density Relations of Soils
- B. Concrete:
 - 01 ASTM C31/C 31M – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 02 ASTM C138 – Standard Test Method for Density (Unity Weight), Yield, and Air Content (Gravimetric) of Concrete.
 - 03 ASTM C143 – Standard Test method for Slump of Hydraulic Cement Concrete.
 - 04 ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 05 ASTM C231 – Standard Test method for Air Content of Freshly Mixed Concrete by the Pressure Method.

- 06 ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Mixed Cement Concrete.
- 07 ACI 301 – Specifications for Structural Concrete for Buildings.
- C. Masonry:
 - 01 ASTM C780-12 – Standard Test Method for Preconstruction and Construction Evaluation for Plain and Reinforced Unit Masonry
 - 02 ASTM C109 / C109-11b – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2 inch cube specimens).
 - 03 ASTM C1019 – Standard Test Method for Sampling and Testing Grout.
 - 04 ASTM C1314 – Standard Test Method for Compressive Strength of Masonry Prisms..

1.5 TESTS CONDUCTED

- A. Earthwork:
 - 01 Existing subgrade under building slabs and paving: In-place density tests for each 2,500 SF, or fraction thereof.
 - 02 Select earth fill at building pad: In-place density tests for each 2,500 SF, or fraction thereof, of each compacted lift.
 - 03 Proctor curve for one type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
 - 04 Liquid limit of fill material.
 - 05 Plastic limit and plasticity index of fill material.
 - 06 Perform moisture content tests for each 5,000 SF of building pad immediately prior to placement of under-slab vapor membrane.
 - 07 Earth fill at new paving: In-place density tests for each 4,000 SF, or fraction thereof, of each compacted lift.
 - 08 Proctor curve for one type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
 - 09 Liquid limit of fill material.
 - 10 Plastic limit and plasticity index of fill material.
 - 11 Trenching and Backfilling: In-place density tests for each 100 LF, or fraction thereof, of each compacted lift.
 - 12 Soil Stabilization: Various tests relative to the requirements of Texas Highway Department Standard Specification for Construction of Highways, Streets and Bridges.
- B. Cast-In-Place Concrete:
 - 01 Review proposed concrete design mixes.
 - 02 Provide full time services for the review of all drilled pier excavation and placement of concrete.
 - a. Include a daily report noting grid lines and locations of each pier drilled.
 - b. After the drilled pier shaft has been drilled, the lab shall test an undisturbed sample and verify that it meets or exceeds the design specification.
 - 03 Provide on-site services for each concrete pour at all structural building concrete grade beams, slab on grade, columns, and other miscellaneous structural concrete.
 - a. Included within this scope of work is the review of all the rebar placement, size, spacing of stirrups, and miscellaneous placement requirements.
 - 04 Cast four (4) concrete test cylinders for every 50 cubic yards or fraction thereof, placed on any day for structural concrete.
 - 05 Cast four (4) concrete test cylinders for each 100 cubic yards, or fraction thereof, placed on any day for all other types of concrete.

- 06 Strength level of an individual class of concrete shall be considered satisfactory when both of the following criteria are met:
 - a. The arithmetic average of any three consecutive strength tests equal or exceed f'_c .
 - b. No individual strength test (average of two cylinders) falls below f'_c by more than 500 psi.
- 07 Conduct slump testing of concrete at intervals equal to test cylinders are made.
- C. Masonry:
 - 01 Provide pre-construction and construction evaluation of proposed mortars and grout(s).
 - 02 Mortar Cubes: Cast four (4) mortar test specimens at random intervals during masonry work; one set specimen per 2,000 SF of surface area of masonry wall or veneer.
 - 03 Masonry Grout: Cast four (4) grout test specimens at random intervals during masonry work; one set specimen per 2,000 SF of surface area of CMU wall, or fraction thereof.
 - 04 Masonry Prisms: Tests shall be conducted for each 2,000 SF of surface area, or fraction thereof, on all CMU exterior (back-up) walls, and interior CMU walls 16' or taller.
- D. Structural Steel:
 - 01 Radiographic inspection shall be provided for all welds called for on the drawings as full penetration butt welds. If welds are inaccessible to radiograph, welds shall have ultrasonic inspection.
 - 02 The testing of welded connections indicated on the drawings shall be paid for from the testing laboratory allowance; however, in the event the fabricator obtains approval from the structural engineers for additional welds not shown on the drawings, the cost of testing those additional welds shall be paid for by the Contractor.
- E. Cementitious Fireproofing:
 - 01 Verify all fireproofing has been installed to the depth(s) required to achieve the specified fire-resistance ratings.
- F. Test Specimens:
 - 01 Concrete Cylinder Specimens: Break one (1) at 7 days and two (2) at 28 days. If the 28 day break average exceeds minimum specified requirements, discard the fourth cylinder. If the 28 day break average is below specified minimum, hold and break the fourth cylinder at 56 days; or process as directed by the structural Engineer.
 - 02 Grout Specimens: Break one (1) at 7 days and two (2) at 28 days. If the 28 day break average exceeds minimum specified requirements, discard the fourth cylinder. If the 28 day break average is below specified minimum, hold and break the fourth cylinder at 56 days; or process as directed by the structural Engineer.
 - 03 Mortar Specimens: Break one (1) at 7 days and two (2) at 28 days. If the 28 day break average exceeds minimum specified requirements, discard the fourth cylinder. If the 28 day break average is below specified minimum, hold and break the fourth cylinder at 56 days; or process as directed by the structural Engineer.

PART 2 – GOVERNMENTAL INSPECTIONS AND CONTRACTOR TESTING

2.1 GOVERNMENTAL INSPECTIONS

- A. The Contractor shall allow in his Proposal the application, coordination, scheduling and cost of all on-site inspections to be performed by governmental authorities having jurisdiction which are required for approval of the Work and occupancy of the building; including, but limited to:
 - 01 City departments
 - 02 County departments
 - 03 Flood Control Districts
 - 04 Municipal Utility Districts
 - 05 Health Departments
 - 06 Fire Marshal Offices
- B. The Contractor shall also cooperate with Owner for all observations required by the Owner.
- C. The Contractor shall make all corrective measures in accordance with instructions received from the governing authority inspector having jurisdiction, as required to receive 100% approval for the work being inspected.
- D. The Contractor shall record and keep record of all governmental agency tests and inspections; including deficiencies noted by the agency, and corrective action(s) taken to receive final approval of the agency.
- E. The Contractor shall bear all costs for initial inspections, re-inspections and any other expenses related to on-site inspections made by governing authorities.
- F. No allowance shall be made for additional Contract Time, nor an increase in the Contract Sum for any unanticipated expenses or delays resulting from failed governmental inspection or resulting re-inspections required to obtain agency approval(s).

2.2 BELOW SLAB SANITARY SEWER TESTING

- A. In addition to normal industry / governmental testing required for the sanitary sewer system, Contractor shall allow in his Proposal the application, coordination, scheduling and cost to provide a static water test(s) as described below.
- B. The Contractor shall perform a static pressure test on all sanitary sewer piping systems below the building slab.
- C. The test(s) shall be maintained continuously from the time the pipe installation is initially tested prior to final cover-up, and continue throughout all foundation preparation and placement of concrete slabs; and terminating a minimum of seven (7) days after the placement of concrete slabs.
- D. Maintain sealed caps on all stub-ups to prevent dissipation of water within the piping system.
- E. Any failure of the static testing indicating leakage during the above period shall be immediately reported to the Architect, MEP Engineer and Owner.
- F. The Contractor shall be responsible for all corrective measures necessary to repair and / or replace defecting piping as directed by the Architect.

PART 3 – OWNER CONSULTANT OBSERVATIONS AND INSPECTIONS

3.1 GENERAL

- A. Throughout the progress of the Work, the Owner's A/E consultants shall make regular site visits and prepare observation reports.
- B. Refer to Specification Section 01 31 29 – Notification of Architect Requirements for specific observations required by the Architect, and the scheduling of such observations.
- C. Contractor and A/E requested subcontractors shall be present for all A/E observations. Coordinate with A/E field representatives as required.
- D. Contractor shall coordinate all trades as required to address issue or deficiencies identified on the observation reports.
- E. Upon completion of corrective measures, Contractor shall note corrective measures, including date(s) on the observation report(s) and distribute the Architect.

3.2 TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR)

- A. The Owner /Architect shall be responsible for interfacing with Texas Department of Licensing and Registration (TDLR) regarding state approval for compliance with Texas Accessibility Standards.
- B. The Owner /Architect shall make the initial submission of the Contract Documents for review.
- C. TAS review comments affecting the Work shall be incorporated into the Work as directed by the Architect either by Addendum, Change Proposal Request, Minor Change or Clarification.
- D. During the progress of the Work, the Contractor shall bring to the Architect's attention any portion of the Work that may be questionably compliant with TDLR / TAS.
- E. The Architect shall coordinate and manage the TAS inspection of the completed project.
 - 01 TAS required corrective measures due to design issues shall be paid for by the Owner.
 - 02 TAS required corrective issues due to Contractor issues (materials, installation, etc.) shall be paid for by the Contractor.
- F. All corrective work shall be completed within thirty (30) days after notification unless otherwise agreed upon by the Owner.

END OF SECTION

SECTION 01 45 23.13

OBSERVATION PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 The Contractor shall coordinate and cooperate with Architect and Architect's Consultants as required for on-site observations and monitoring of the Work.
- C. Related Work:
 - 01 Section 01 31 29 – Notification of Architect Requirements
 - 02 Section 01 45 23 – Testing and Inspection Services

1.1 RELATED REQUIREMENTS

- A. Coordination, scheduling and implementation of inspections and testing required by laws, ordinances, rules, regulations, orders or approvals, or public authorities required for interim and final approval of the Work shall be the sole responsibility of the Contractor.
- B. Contractor shall maintain a log of all required governmental interim and final inspections throughout the progress of the Work.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Throughout the progress of the Work, the Owner's A/E consultants shall make regular site visits and prepare observation reports.
- B. Contractor and requested subcontractors shall be present for all A/E observations. Coordinate with A/E field representatives as required.
- C. Contractor shall coordinate all trades as required to address issue or deficiencies identified on the observation reports.

2.2 OBSERVATION REPORTS

- A. Upon completion of on-site observations by the Architect and Architect's Consultants, documentation of the Observation shall be furnished to the Contractor.
- B. Observation report items that reflect instructions for corrective measures shall be addressed / corrected by the Contractor in a timely manner.

- C. Upon completion of corrective measures, Contractor shall detail corrective measures, including date(s) of work and date(s) of Contractor's verification of completeness on the observation report(s) and return a copy the Architect and Consultant as appropriate.
- D. Wherever possible, Contractor's written documentation shall include all corrective work identified to be addressed on the observation report. Minimize piece meal responses as much as possible.
- E. A complete history of Contractor's observation responses shall be required to be submitted as a condition of project close-out.

PART 3 – GENERAL – PROJECT CONSULTANT OBSERVATIONS

3.1 DESCRIPTION

- A. The Contractor shall allow in his Proposal the coordination and scheduling of Observations to be performed by the Owner's project consultants; including the Architect, MEP Engineer, Structural Engineer, Food Service Consultant, Theater Consultant, and Special Systems Consultants as they may apply to this Work.
- B. All project consultant observation services shall be performed by designees of the relative Consultant; upon which the Contractor may rely as to the capability and thoroughness of the observation being performed. Upon request by the Contractor, the names of A/E Field Representatives performing specific observations shall be furnished by the Architect.
- C. The Owner shall pay for the observation services of the project consultants in accordance with the Owner – Architect Agreement and the requirements of the Contract Documents. Excessive observations and re-observations resulting from the Contractor's actions as described in this Section, shall be paid for by the Contractor directly to the affected Consultant.
- D. The Contractor shall cooperate with the Owner's project consultants in all matters pertaining to required observations of the work as described in the Contract Documents. The Owner retains the option to add to or delete any or all observations specified herein; and thereby accept the relative work without observation.
- E. Refer to Section 01 31 29 – Notification of Architect Requirements for additional information.

3.2 RELATED REQUIREMENTS

- A. Conditions of the Contract, AIA Document A201, and Supplementary Conditions to the General Conditions for the Construction Contract, Specification Section CB.
- B. Respective Sections of Specifications describing the required consultant observations.

3.3 AUTHORITIES AND DUTIES OF THE A/E FIELD REPRESENTATIVES

- A. The project consultant representatives are not authorized to revoke, alter, relax, increase, or release the Contractor from any requirement of the Contract Documents without written notice furnished to the Contractor by the Architect.
- B. When it appears that the material, assembly or work performed by the Contractor fails to fulfill Contract requirements, the project consultant representative shall promptly notify the General Contractor, Architect and Owner.

- C. The project consultant representative(s) shall promptly distribute copies of the observation reports. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor.

3.4 PROJECT CONSULTANT OBSERVATION GUIDELINES AND PROCEDURES

- A. Project Consultants shall make all observations required in the Contract Documents and requested by the Contractor and Owner.
- B. For each material, assembly or phase observation required in the Contract Documents, and upon request by the Contractor, the project consultant(s) shall perform the following observations as required in the Owner – Architect Agreement; and shall be at the expense of the Owner in accordance with the Owner – Architect Agreement.:
 - 01 Initial observation to determine compliance with the Contract Documents.
 - 02 Observation to determine deficiencies where the initial observation results do not show 100% compliance with the Contract Documents. At the Consultant's discretion, this observation may be performed concurrent with the initial observation.
 - 03 Re-observation to determine 100% compliance with the Contract Documents.
- C. In the event the observation series described above does not result in 100% approval of the material, assembly or phase being inspected, all subsequent re-observations required to achieve 100% approval shall be at the sole expense of the Contractor to be paid directly to the project consultant based on the Consultant's standard hourly rates for time expended, including travel to and from the site.
- D. Recognizing the size and complexity of work included in a project may be sufficiently large enough to require the project to be divided into scope areas, each such area shall be considered separate and stand-alone with respect to Paragraph 3.4-B above.
 - 01 Requests by the Contractor for project consultant observations of partial scope completion areas shall be considered observations of the entire scope area with respect to Paragraph 3.4-B above; and subsequent observations of the remaining portions of the same scope area shall be paid for directly to the Consultant by the Contractor.
 - 02 Consultants shall invoice the Contractor on a monthly basis, and payment shall be due upon the Contractor's receipt of the invoice.
- E. The Contractor shall bear the responsibility of requesting and scheduling all project consultant observations required by the Contract Documents. The Contractor shall give the project consultant a minimum of forty-eight (48) hours' notice prior to the requested observation.
 - 01 No extension of Contract Time shall be granted for untimely observations due to the Contractor's failure of proper observation request notification.
- F. Observations voluntarily made by project consultants at their discretion, not specifically requested by the Contractor, shall not count as one of the observations described in Paragraph 3.4-B above, nor shall the Contractor be liable for any related expenses.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide temporary facilities adequate to facilitate the requirements to complete the Work.
 - 02 Any areas disturbed by the placement of temporary facilities shall be repaired / replaced to a finished condition consistent with the surrounding finished area.
- C. Related Work:
 - 01 Section 01 56 39 – Temporary Tree and Plant Protection

PART 2 - GENERAL

2.1 GENERAL

- A. Unless otherwise agreed upon or stipulated in the Contract Documents, the Contractor shall provide all necessary temporary facilities required to effectively implement and complete the Work.
- B. Temporary facilities shall be provided only for the duration of construction, unless agreed upon otherwise, and all temporary facilities shall be completely removed at the completion of the project.
- C. Any areas disturbed by the placement of temporary facilities shall be repaired / replaced to a finished condition consistent with the surrounding finished area.

2.2 UTILITIES

- A. The Contractor shall supply temporary job power for the Work. The Contractor shall provide all wiring, lamps, distribution of power and similar equipment as required for construction, inspection, and testing of each project.
 - 01 Coordinate with the local power provider as required.
 - 02 The Contractor is responsible for overloading or excess use, or any damage resulting from overloading or excess use, or any damage resulting from his use of utilities.
 - 03 For work at existing campuses / buildings, Contractor may have access to existing 110 / 120 volt receptacles. Coordinate with Owner to confirm access and usage.
- B. The Contractor shall supply reliable data / internet capability at the job site trailer for use by the Contractor, Architect and Owner.

- 01 Contractor shall provide hard wired data connections as required for his use.
- 02 The Contractor provide wireless connectivity (i.e. mobile broadband devices) for use by up to five (5) simultaneous users and a minimum speed of 50Mb per second.
- C. The Contractor shall supply temporary water for the Work. The Contractor shall provide all distribution, valves, fixtures and similar equipment as required for construction, inspection, and testing of each project.
 - 01 Coordinate with the local provider as required.
 - 02 The Contractor is responsible for overloading or excess use, or any damage resulting from overloading or excess use, or any damage resulting from his use of utilities.
 - 03 For work at existing campuses / buildings, Contractor may have access to existing water supply / hose bibbs. Coordinate with Owner to confirm access and usage.
- D. The Contractor shall provide temporary heat to prevent freezing and maintain proper temperatures to avoid damage to materials and assemblies in the building.
- E. The Contractor shall provide and maintain such dependable source of temporary utilities as may be necessary until the building is converted to permanent power and utility connection(s).
- F. Where a permanent irrigation system is not in use, the Contractor shall be required to provide temporary water and electrical connections for irrigation sprinkler systems at sports fields.
 - 04 These connections must be maintained through the duration of the Contract, or until the work is accepted, whichever is later.

2.3 FIELD OFFICE

- A. The Contractor will be required to furnish a job trailer installed at a suitable location (on site), for use by the Owner, Contractor, and Architect.
 - 01 Coordinate with the Owner and Architect for acceptable location.
- B. Provide and maintain a weather-tight building with operable and lockable door and windows, to serve as a job office available to the Contractor, subcontractors, and the Architect.
- C. Provide lights, electricity, air conditioning and heat, as required.
- D. Remove office from premises at completion of work or when a similar area / room can be set up inside the building, contingent on approval from the Owner.
- E. Provide job site data / computer connection, telephone and fax, and other miscellaneous items as outlined below.
 - 01 The job site trailer shall have a hard-wired data service for Contractor's use.
 - 02 Contractor's office shall be of a size, and shall be furnished, so that it may be used for progress meetings.
 - 03 Provide adequate artificial lighting, heating, and cooling to provide comfortable conditions for occupants.
- F. Furnishings Required:
 - 01 Contractor's Office: Racks and files for Contract Documents and for Record Documents; conference table and chairs; and desks and chairs as required by Contractor.

- 02 Architect's Office: One plan table large enough to house a full size set of drawings and a chair.

2.4 SANITARY FACILITIES

- A. Furnish temporary sanitary facilities and maintain in compliance with regulations of State Department of Health and other authorities having jurisdiction.
- B. Maintain a regular service schedule for the facilities.
- C. Use of Owner's sanitary facilities is strictly prohibited.

2.5 STORAGE FACILITIES

- A. Provide and maintain adequate weather tight, lockable, enclosed storage facilities as required to securely house materials and equipment stored on the job site.
 - 01 Coordinate with the Owner and Architect for acceptable location(s).
- B. Replace materials improperly stored and damaged by weathered conditions.
- C. Allow for temporary freeze protection as required.
- D. Remove storage facilities at completion of work or when materials are stored within the structure in a weather tight condition.

2.6 SIGNS

- A. Within three (3) weeks after receipt of Notice to Proceed, provide one project identification sign and install at designated location at the site.
- B. Fabricate the sign with sturdy wood framing and 3/4 inch thick exterior grade plywood, with medium density overlay, and a minimum area of 64 square feet (4' x 16' or 8' x 8').
- C. Erect signs on 4" (102 mm) x 4" (102 mm) supports set firmly into the ground and well braced. The bottom of the sign is to be a minimum of 4' above grade, unless otherwise instructed by the Architect.
- D. Prime wood surfaces and apply one coat of exterior house paint, in not more than three distinct colors.
- E. Architect shall provide camera ready artwork for use in making the project sign; and shall include:
 - 01 The official title of the Project.
 - 02 The name of the Owner.
 - 03 3-D rendering
 - 04 The names and titles of School Board Members and School Administrators.
 - 05 The names of Architect and professional consultants.
 - 06 Name of the Contractor / Construction Manager.
- F. Other signs permitted at the site:
 - 01 Warning signs.
 - 02 Directional signs.
 - 03 Identification signs at field offices.
- G. Allow no other signs to be displayed at the project site, unless authorized by the Owner.

- H. Secure and pay for all sign permits as required by local authorities.

2.7 BARRIERS

- A. Provide temporary barricades on all portions of the site adjacent to the construction and accessible to the public.
 - 01 Temporary barricades shall be a minimum 72" tall chain link, self-supported fence.
 - 02 Provide lockable personnel and equipment gates as required for adequate access.
 - 03 Maintain fencing in good condition throughout the progress of the Work.
- B. Where Work occurs on existing campuses or buildings, coordinate with the Owner and Architect for layout of fencing to facilitate normal Owner operations as much as possible.
- C. Provide approved barriers around trees and plants designated to remain as required to protect against damage from vehicular / personnel traffic, stored materials, dumping, chemically injurious materials, and water ponding.

2.8 SECURITY

- A. Determine if and when watchmen are necessary for protection to the work, and provide such services when necessary.
- B. Neither the provision of watchmen nor the failure to provide watchmen shall relieve the Contractor of responsibility in event of injury to persons or damage to property.

2.9 CLEANING

- A. Trash Removal:
 - 01 Clear the building and site of trash a minimum of once a week.
 - 02 When rapid accumulation occurs, make more frequent removals.
 - 03 Remove highly combustible trash such as paper and cardboard daily.
 - 04 Dumpsters will not be allowed to overflow and should be emptied on a regular basis.
 - 05 Use of Owner's dumpsters and trash receptacles is strictly prohibited.
- B. Disposition of Debris:
 - 01 Remove debris from the site and legally dispose of in strict accordance with local ordinances and regulations.
 - 02 Locations for disposal shall be of the Contractor's choice within the above restriction.
 - 03 No debris or material may be buried or burned at the site.
 - 04 Take necessary precautions to prevent accidental burning of materials by avoiding large accumulations of combustible materials.
- C. Cleaning:
 - 01 Maintain installed work in a manner that will protect the work.
 - 02 Thoroughly clean the work, including the removal of smudges, marks, stains, fingerprints, soil, dirt, paint spots, dust, lint, discolorations, and other foreign materials.

2.10 TEMPORARY FIRST AID FACILITIES

- A. Provide first aid equipment and supplies, with qualified personnel continuously available

to render first aid at the site.

- B. Provide a sign, posted at the telephone, listing the telephone numbers for emergency medical services: physicians, ambulance services and hospitals.

2.11 TEMPORARY FIRE PROTECTION

- A. Provide a fire protection and prevention program for employees and personnel at the site.
 - 01 For work on existing campuses or buildings, coordinate with the Owner and Architect to develop a program that will facilitate the Owner's needs (i.e. building evacuation and similar).
 - 02 Where existing building users must evacuate into a work area, coordinate with the local fire marshal having jurisdiction to implement temporary measures required to maintain life safety code compliance.
- B. Provide and maintain fire extinguishing equipment ready for instant use at all areas of the project, and at specific areas of critical fire hazard.
- C. Equipment:
 - 01 Hand extinguishers of the types and sizes recommended by the National Board of Fire Underwriters to control fires from particular hazards.
 - 02 Barrels of water with buckets designated for fire control purposes.
 - 03 Water hoses connected to an adequate water pressure and supply system.
 - 04 Construction period use of permanent fire protection system.
- D. Enforce Fire-safety Discipline:
 - 01 Store volatile materials in an isolated, protected location.
 - 02 Avoid accumulations of flammable debris and waste in or about the Project.
 - 03 If allowed on site at all, prohibit smoking in the vicinity of hazardous conditions.
 - 04 Closely supervise welding and torch-cutting operations.
 - 05 Supervise locations and operations of portable heating units and fuel.
- E. Maintain fire extinguishing equipment in working condition, with current inspection certificate attached to each extinguisher.

2.12 CONSTRUCTION AIDS

- A. Provide construction aids and equipment required to assure safety for personnel and to facilitate the execution of the work; including, but not limited to scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other equipment.
- B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
- C. Maintain all equipment in a first-class, safe condition.

2.13 ACCESS ROADS AND PARKING AREAS

- A. Provide adequate temporary roads and walks to achieve all-weather access into the site from public thoroughfares, and within and adjacent to the site, as necessary to provide uninterrupted access to field offices, work and storage areas.
- B. For work performed on existing, occupied site, coordinate with the Owner and Architects for location(s) of temporary access and construction parking.

- 01 Where Contractor is allowed to use existing access roads, paving, parking, sidewalks and similar, Contractor shall thoroughly photograph or video all such areas to document existing conditions.
 - 02 Contractor shall repair / replace any area(s) damaged as the result of construction activities.
- C. Provide adequate parking space for personnel and employees at the site, located to avoid interference with traffic, work or storage areas, or with materials-handling equipment.
 - D. Grade and provide drainage facilities to assure runoff of rainwater and to avoid blockage of flow from adjacent areas.
 - E. All temporary access roads and walks shall be removed upon completion of permanent facilities, or completion of construction.
 - F. All disturbed areas shall be minimally regenerated to their original condition.

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide protection at existing trees and planted materials designated to remain on site as required to prevent damage or degradation.
- C. Related Work:
 - 01 Section 31 11 00 – Clearing and Grubbing
 - 02 Section 31 20 00 – Earth Moving
 - 03 Section 31 22 19 – Finish Grading
 - 04 Section 31 23 33 – Trenching and Backfilling
 - 05 Section 31 32 13.19 – Lime Soil Stabilization

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed materials and assemblies to be used to protect existing trees.
 - 01 Shop Drawings shall indicate limits of fencing and all new work that may occur within the protection zone.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Prior to start of Work, Contractor shall photographically document existing vegetation, plants and trees in order to capture the condition of existing vegetation, plants and trees.

- 01 Such documentation shall be used at the conclusion of the Work to verify that vegetation, plants and trees are in the same condition prior to start of the Work.

1.2 QUALITY ASSURANCE

- A. A pre-construction meeting shall be given to explain tree preservation and treatment during the construction process by the Architect.
- B. Site preparation work shall not begin in any area where tree preservation and treatment measures have not been completed.
- C. Site improvements shall be staked by the Contractor in order to facilitate location of trenching and fencing operations.
- D. Any roots exposed by construction activity shall be pruned flush with the ground and covered with backfill as soon as possible. If exposed roots are not to be covered with backfill within twenty-four (24) hours, cover with a mulch or material in order to reduce soil temperature and minimize water loss due to evaporation.
- E. Any work, excavation or grading required within protected root zone areas shall be limited to 3 inches cut or fill, with no roots over 3/4 inch diameter being out, and done by hand or with approved equipment and root protection.

1.3 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 01 Storage of construction materials, debris, or excavated material
 - 02 Parking vehicles or equipment
 - 03 Foot traffic
 - 04 Erection of sheds or structures
 - 05 Impoundment of water
 - 06 Excavation or other digging unless otherwise indicated
 - 07 Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 – PRODUCTS

2.1 TREE PROTECTION MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter, and free of weeds, roots, and toxic and other non-soil materials.
 - 01 Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.
- B. Topsoil: Complying with plant material notes as indicated on the Drawings.
- C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees

and shrubs, consisting of one of the following:

- 01 Type: Pine Straw
- 02 Color: Natural
- 03 Application: Four (4) inches thick

D. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

- 01 Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2 inch (50 mm) opening, 0.148 inch (3.76 mm) diameter wire chain-link fabric; with pipe posts, minimum 2 -318 inch (60 mm) OD line posts, and 2-718 inch (73 mm) OD corner and pull posts; with 1-518 inch (42 mm) OD top rails, with 0.177 inch (4.5 mm) diameter top tension wire and 0.177 inch (4.5 mm) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
- 02 Height: 6 feet (1.8 m)
- 03 Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches (914 mm)

E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:

- 01 Size and Text: 18"x 24"
- 02 Lettering: 3 inch (75 mm) high minimum, white characters on red background

2.2 IMPLEMENTATION

A. A 24" deep x 4" wide trench shall be cut 1'-0" in from the new concrete line, lined with polyurethane plastic sheeting and backfilled. Plastic should line both sides of trench and ends of plastic should be exposed to assure proper positioning. The trench is to protect the existing root system from damage. The plastic is to restrict leaching of lime to the roots during the lime stabilization process.

B. A temporary protective fence shall be installed completely around the existing trees to remain. The location of the protective fence shall be verified with Architect. The protected area shall not be used for any reasons, including material, vehicular, and equipment storage or vehicular traffic and parking.

C. A certified Arborist shall be contracted to trim trees in the protected area, and oversee and verify that the root systems have not been damaged during the construction process. The following is a list of locally approved Arborists:

- 01 Champions Tree Services, Inc.
- 02 Davey Tree Service
- 03 Trees Incorporated

D. Trimming Operation:

- 01 The Architect and Owner shall be notified of all trimming.
- 02 Trees to be trimmed will include only trees affected by construction and those requiring maintenance in the preservation areas.
- 03 Trees to be trimmed will be designated flagged in the field.
- 04 Trees to be removed shall be designated by Architect.
- 05 A list of the trees to be trimmed and the prescribed tree treatment will be provided by the Arborist.
- 06 Trimming shall consist of the following methods:
 - a. Class IV - Crown Reduction Pruning (reference National Arborist Association Standards for Pruning of Shade Trees 1988). Special

- trimming procedure to reduce crown of trees up to 30 percent, to prevent impact and stress of preservation trees. Corrective pruning and removal of all deadwood larger than 1 inch diameter will be required.
 - b. Removal of all vines from trees.
 - c. Removal of designated and or hazardous trees. All stumps shall be ground down 6 inches below grade.
 - d. All chips produced from the trimming operation shall be left on site for Owner's use, unless otherwise directed. Chips will be blown onto or spread over preservation areas.
 - 07 All wood not chipped shall be hauled from site. No burning will be allowed on site.
- E. Root Pruning Trenching Operation:
 - 01 Trenching areas shall be designated and exact locations will be marked in the field.
 - 02 Trenching depth shall be 2 foot minimum.
 - 03 Where excavation over 3 inches in depth is to occur within the root zone area of a preserve tree, make a clean cut (a minimum of 2 feet deep) between the designated disturbed and undisturbed root zone area, with a trenching machine, in order to minimize damage to the undisturbed root zone.
 - 04 Trench shall be backfilled and compacted immediately after trenching.
- F. Tree Protection Fencing Installation:
 - 01 Tree protection fence - the exact locations will be marked in the field by the Architect.
 - 02 No access to fenced areas shall be permitted without prior approval by the Architect.
 - 03 Contractor shall provide maintenance and repair of fence during site work construction.
 - 04 Fence shall be removed after completion of site work construction, unless otherwise notified.
- G. Fertilization Treatment:
 - 01 All preservation trees shall be treated, as designated by the Architect.
 - 02 Injection of a liquid mix of 50 percent Doggett XL Injecto feed and 50 percent "Maxicrop" into the root zone area of trees shall consist of the following method:
 - a. Mix one pound of "Maxicrop" per 100 gallons water with Doggett XL Injecto Feed per label instructions in tank with agitation capability.
 - b. Inject the mixture on a 3 foot square grid at 5 gallons per 100 square feet.
 - c. Injection pressure shall be 100-150 psi as soil conditions warrant.
 - d. Depth of injection will be 12 inches.
 - 03 Mix approved wetting agent by label directions with mixture in order to provide better distribution and penetration of materials into soil.
- H. Repair Operations:
 - 01 If any damage to preservation trees should occur beyond what is expected during the construction period, the Architect and Arborist shall appraise the damage and order the repair by the Contractor or responsible party.
 - 02 Trees lost due to contractor's negligence during the construction period shall be appraised by the Arborist and the Owner compensated or replacement trees provided.

2.3 REPAIR AND REPLACEMENT

- A. The Contractor's photographic documentation of existing vegetation, plants and trees prior to start of Work shall be used to compare against condition vegetation, plants and trees at the conclusion of the Work.
- B. The Contractor shall repair and / or replace all existing vegetation slated to remain that have been damaged as a result of Contractor activities.
- C. Such repair and / or replacement shall restore vegetation, plants and trees to their original condition prior to start of Work at no expense to the Owner.
- D. Replacement of vegetation, plants and trees shall be the same species and size of the original specimen.
- E. All repairs and / or replacements shall be made at no additional cost to the Owner.

END OF SECTION

SECTION 01 57 13 – EROSION AND SEDIMENTATION CONTROL

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section pertains to the implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Storm Water Pollution Prevention Plan (SWPP PLAN), on the plans or required by the Texas Pollutant Discharge Elimination System (TPDES) General Permit TXR150000.
- B. The Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, Phase II, regulations from the Clean Water Act.

1.02 DEFINITIONS

- A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavation activities, as well as other construction related activities (e.g., stock piling of fill material, demolition).
- B. Large Construction Activity: Project that:
 - 1. Disturbs five acres or more, or
 - 2. Disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.
- C. Small Construction Activity: Project that:
 - 1. Disturbs one or more acres but less than five acres, or
 - 2. Disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.
- D. TPDES Operator:
 - 1. Operator - The person or persons associated with a large or small construction activity that is either a primary or secondary as defined below:
 - a. Primary Operator – the person or persons associated with a large or small construction activity that meets either of the following two criteria:
 - i. The persons have operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
 - ii. The person or persons have day-to-day operational control of those activities at a construction site that are necessary to ensure compliance with a storm water pollution prevention plan (SWPP PLAN) for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWPP PLAN or comply with other permit conditions).
 - b. Secondary Operator – The person whose operational control is limited to the employment of other operators or to the ability to approve or disapprove changes to plans and specifications. A secondary operator is also defined as a primary operator if there are no other operators at the construction site.

- E. Best Management Practices (BMP's): Physical facilities schedules of activities, prohibition of practices, maintenance procedures, and other management practices, when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
- F. Block Sodding: Sodding for erosion control and for final stabilization shall consist of providing and planting Bermuda grass, San Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with the specification requirements herein outlined.
- G. Hydromulch Seeding: Seeding, followed by the application of a mulch erosion control blanket shall consist of preparing the ground, sowing of seeds, application of a fertilizer, and stabilization with mulch consisting of a biodegradable fiber along and across such areas as are designated on the plans and in accordance with these specifications
- H. Silt Fence: The reinforced filter fabric barrier consists of geotextile fabric supported by a net reinforced fence stretched across and attached to supporting posts or frame and entrenched. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.
- I. Inlet Protection Barriers: The inlet protection barrier consists of a geotextile fabric (filter fabric) supported by a net reinforced fence structure and constructed around a storm drain inlet, catch basin, or culvert. An alternative design of the inlet protection barrier, as approved by the Engineer, consists of fiber rolls placed around a frame, staked in place (or weighted down with clean gravel bags), and constructed around a storm drain inlet, catch basin or culvert. This work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation. As designated on the plans and in accordance with these specifications.
- J. Sediment Basins: A sediment basin is a temporary basin or dam constructed across a waterway or excavated location to intercept sediment-laden runoff and to trap and retain the sediment. A sediment basin is usually installed at points of discharge from drainage areas greater than 5 acres. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.
- K. Stabilized Construction Access: This work shall consist of the installation of temporary erosion protection and sediment control stabilized construction access - type I, rock, utilized during construction operations and prior to final stabilization, in accordance with these specifications and construction drawings.
- L. Rock Filter Dams: Rock filter dams are temporary berms constructed of stone to intercept and slow storm water runoff to retain sediment on the construction site.
 - 1. Depending upon the type of rock filter dam specified in the construction plans as Type 1, 2, 3, or 4, the aggregate fill may be unwrapped, wrapped in twisted

hexagonal wire mesh, or confined in a gabion wire basket. Applications of Rock Filter Dams are as follows:

- a. Type 1 dams may be used at toe of slopes, around inlets, in small ditches, and at dike or swale outlets. Type 1 dams are recommended for erosion and sediment control from a drainage area of 5 acres or less.
- b. Type 2 dams may be used in ditches and at dike or swale outlets.
- c. Type 3 dams may be used in stream flow.
- d. Type 4 sack gabions may be used in ditches and smaller channels to form an erosion and sediment control dam

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Submit a copy of the Storm Water Pollution Prevention Plan (SWPP Plan).
- B. Submit a copy of the Notice of Intent (NOI).
- C. Submit a copy of the Notice of Termination (NOT).
- D. Submit manufacturer's literature for product specifications and installation instructions.
- E. Submit manufacturer's catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.
- F. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.
- G. Submit shop drawings for inlet baskets.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

PART 2 – PRODUCTS

2.01 SUSTAINABLE MATERIALS

- A. Contractor shall strive to utilize sustainable materials, which include rapidly renewable materials, regional materials, regionally manufactured materials, regionally extracted materials, recycled contents.

2.02 GRASS

- A. Materials for erosion control seeding shall conform to the requirements of 32 92 13 – Hydromulch Seeding.
- B. Materials for erosion control seeding shall conform to the requirements of 32 92 00 – Turf and Grasses.

2.03 BANK SAND BACKFILL

- A. Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:
 - 1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
 - 2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: PI not exceeding 7.

2.04 WATER

- A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
- B. Water sources other than the local municipal domestic water supply must be approved by the Owner's Representative.
- C. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words "non-potable" water.

2.05 STABILIZED CONSTRUCTION ACCESS

- A. Provide crushed aggregate for long- and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft or flaky materials, and organic and injurious matter. Use 4 to 8-inches aggregate for Type 1. Use 2 to 4-inches aggregate for Type 3.

2.06 SILT FENCE

- A. Woven or nonwoven geotextile filter fabric made of polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.
- B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), CBR puncture strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.

- C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.
- D. Provide net reinforcement of at least 12.5 gauge (SWG) galvanized welded wire mesh, with a maximum opening size of 2 × 4 in., at least 24 in. wide, unless otherwise shown on the plans.
- E. TenCate Geosynthetics, Contech Engineered Solutions, or equivalent.

2.07 INLET PROTECTION BARRIERS

- A. Geotextile shall be per the requirements of paragraph 2.6 of this section.
- B. Provide net reinforcement of at least 12.5 gauge (SWG) galvanized welded wire mesh, with a maximum opening size of 2 × 4 in., at least 24 in. wide, unless otherwise shown on the plans.
- C. Barrier Stakes: Nominal 2 by 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 12 inch bury and full height of filter fabric.

2.08 DROP INLET BASKET

- A. Provide steel frame members in accordance with ASTM A36.
- B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket.
- C. Weld a minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

2.09 SANDBAGS

- A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
 - 1. Minimum unit weight of four ounces per square yard.
 - 2. Minimum grab strength of 100 lbs in any principal direction (ASTM D4632).
 - 3. Mullen burst strength exceeding 300 lbs (ASTM D4833).
 - 4. Ultraviolet stability exceeding 70 percent. After 500 hours of exposure (ASTM 4355).
 - 5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: Approximately 40 to 50 pounds not to exceed 75 pounds.

2.10 BAGGED GRAVEL BARRIER

- A. Provide a bagged gravel barrier.
 - 1. Minimum unit weight of four ounces per square yard.

2. Minimum grab strength of 100 lbs in any principal direction (ASTM D4632).
3. Mullen burst strength exceeding 300 lbs (ASTM D4833).
4. Ultraviolet stability exceeding 70 percent. After 500 hours of exposure (ASTM 4355).
5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: Approximately 40 to 50 pounds not to exceed 75 pounds.

2.11 ROCK FILTER DAM

- A. Materials. Geotextile fabric shall consist of a woven monofilament or spunbond nonwoven fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins. Geotextile fabric shall equal or exceed the following average roll values or as directed by the Engineer:
 1. Minimum average roll value.
 - a. Elongation ³ 50 percent.
 - b. Grab Strength – 200 pounds.
 - c. Puncture Strength – 75 pounds.
 - d. UV Stability (retained strength) – 50 percent after 500 hours of exposure.
 2. Maximum average roll value.
 - a. Apparent Opening Size (AOS) – 0.6 mm/#30 US sieve.
- B. Geotextile fabric shall be resistant to commonly encountered soil chemicals, mildew, rot, insects, and deterioration resulting from exposure to sunlight or heat. Geotextile fabric shall provide an expected useable life comparable to the anticipated construction period.
- C. Aggregate for the rock filter dams shall consist of crushed stone. Aggregate particles shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials or organic and injurious matter. Aggregate shall be cubic or rounded form, not elongated, flat, shapes. Spalls, fragments, and chips shall not exceed 5 percent by weight. Crushed concrete may be substituted for the crushed stone. Aggregate size shall depend upon the type of rock filter dam specified in the construction plans. Aggregate size based on type of rock filter dam is as follows:
 1. Type 1: 3 inches to 5 inches, open-graded.
 2. Type 2: 3 inches to 5 inches, open-graded.
 3. Type 3: 4 inches to 8 inches, open-graded.
 4. Type 4: 3 inches to 5 inches, open-graded.
- D. Mesh is required for reinforced type rock filter dams. Mesh shall be 20 gauge galvanized double twisted hexagonal wire mesh with 1-inch diameter hexagonal openings. Mesh wire shall be zinc coated prior to being double twisted. Reinforcing spiral binders, lacing wire, and stiffeners shall be made of wire having the same coating material and same wire size as the wire mesh. Gabion wire baskets shall equal or exceed the requirements of the wire mesh.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction. Restore damaged improvements to their original condition, as acceptable to Owner.
- C. Plan Work to minimize the time areas are to be exposed without vegetative cover.
- D. Prepare a SWPP Plan following the requirements of the Construction General Permit and the requirements of the local MS4. If conflicts exist between the Construction General Permit and the requirements of the MS4, the more stringent requirements will apply.
 - 1. Update or revise the SWPPP as needed during the construction following the requirements of the Construction General Permit.
 - 2. Submit the SWPPP and any updates or revisions to the Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.
- E. Notice of Intent for Large Construction Activity
 - 1. Fill out, sign, and date TCEQ Notice of Intent (NOI) form for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000) for the Contractor and Owner.
 - 2. Transmit the signed Contractor's and Owner's copy of the NOI, along the required fees to the TCEQ. Provide a copy of the documents to the Owner's Representative.
 - 3. Submission of the Notice of Intent form by the Contractor and Owner is required a minimum of seven days before Commencement of Construction Activities.
- F. Construction Site Notice for Small Construction Activity
 - 1. Fill out, sign, and date the Construction Site Notice, contained in the TPDES General Permit TXR 150000.
 - 2. Transmit the signed Construction Site Notice to Owner's Representative at least seven days prior to Commencement of Construction Activity.
- G. Certification Requirements
 - 1. Complete the Large Construction Site "Primary Operator" Notice.
 - 2. Contractor shall complete the Large Construction Site "Secondary Operator" Notice and provide it to the Owner and Subcontractor's for signature.
 - 3. Submit properly completed certification forms to the Owner's Representative for review before beginning construction operations.
 - 4. Conduct inspections in accordance with TCEQ requirements. Use the EPA NPDES Construction Inspection Form to record maintenance inspections and repairs.
- H. Post the following notices from effective date of the SWPP Plan until date of final site stabilization as defined in the Construction General Permit:
 - 1. Post the TPDES permit number for Large Construction Activity, with a signed TCEQ Construction Site Notice for large or Small Construction Activity. Signed copies of the Contractor's and Owner's NOI, as applicable, must also be posted.

2. Post notices near the main entrance of the construction site in a prominent place where it is safely and readily available for viewing by General Public, Local, State, and Federal Authorities. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWPP PLAN.
 - a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with The Owner's Representative to conform to requirements of the Construction General Permit.
 - b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
 3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction access area.
 4. Post a notice of waste disposal procedures in a readily visible location on site.
- I. Keep a copy of this document and the SWPP Plan in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWPP Plan implementation shall have a copy of the SWPP PLAN available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWPP Plan. Upon submission of the NOT, submit all required forms and a copy of the SWPP Plan with all revisions to the Owner's Representative.

3.02 GENERAL

- A. Use all means necessary to control dust on or near the site resulting from the performance of the Work. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, adjacent uses, and concurrent work on site. Moisture level during compaction operations shall not exceed that amount as specified by Geotechnical Engineer.
- B. Install erosion control systems at the site's boundary at locations where stormwater runoff will leave the site prior to starting any clearing, stripping, or earthwork operations.
- C. Properly dispose of solid waste, paints, solvents, cleaning compounds, etc.
- D. Store construction materials in designated areas away from drainageways and low areas.
- E. Construct containment berms and utilize drip pans at fuel and liquid storage tanks and containers.

3.03 INSTALLATION OF EROSION CONTROL DEVICES

- A. Install erosion control devices to protect adjacent and downstream properties from damage and pollution resulting from erosion caused by the work of this Contract. Implement erosion control measures indicated on drawings and additional erosion control measures necessary to prevent damage to adjacent and downstream properties.

- B. Install silt fence located along perimeter of site or grading limits immediately following site clearing operations specified under Division 31 Section 31 11 00 – Clearing and Grubbing.
 - 1. Install silt fence fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints. Create joints in fabric by securely fastening fabric at the support post with overlap extending to the next post.
 - 2. Drive support post into ground not less than 18 inches.
 - 3. Excavate a 4-inch wide by 4-inch deep trench on up-slope side of silt fence.
 - a. Line trench with silt fence fabric material.
 - b. Backfill trench with soil or gravel.
- C. Install inlet protection barriers at all inlets.
- D. Stabilized Construction Access
 - 1. Provide stabilized construction roads and access at construction, staging, parking, storage, and disposal areas to keep street clean of mud carried by construction vehicles and equipment. Construct erosion and sediment controls in accordance with Drawings, Specification and any requirements of the authority having jurisdiction.
 - 2. Place the exit over a foundation course, if necessary. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap.
 - 3. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as required.
 - 4. Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.

3.04 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- C. Stockpile Topsoil may not exceed 6 feet in height.

3.05 FIELD QUALITY CONTROL

- A. Testing shall be the responsibility of the Owner and costs of initial testing shall be paid by Owner. Cost of all subsequent testing necessary due to non-compliance with specifications shall be paid by Contractor.
- B. Density Test:
 - 1. Frequency and scope of testing shall be established by Geotechnical Engineer, and as required by local jurisdictional authority. If Geotechnical Engineer has not established a frequency of testing in the Geotechnical Report, testing shall

- be at every 100 linear foot of trench at a minimum of one per lift and a minimum of one per day.
2. Tests shall be performed in accordance with the referenced Standards.
 3. Laboratory tests for moisture density relations shall be determined in accordance with ASTM D 1557. A minimum of one test shall be performed for each major soils type. In addition, sufficient number of retests or check points shall be performed to evaluate accuracy of maximum density values being used.
 4. Field in-place density shall be determined in accordance with ASTM Test Methods D 1556 or D 2922, and the moisture-density relations shall be determined in accordance with ASTM Test Method D 1557.
 5. Reopen improperly compacted trenches to depth directed, then refill and compact to the specified density at no additional cost to Owner

3.06 DRAINAGE CONTROLS

- A. Provide all necessary temporary apparatus, pumps, curbs or ditches as required to divert or convey water from any source away from the Work. Do not allow water from any source to accumulate within or damage trenches.

END OF SECTION 31 22 13

SECTION 01 71 36

PROTECTION OF EXISTING CONSTRUCTION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide covering protection at existing floor, wall and ceiling finishes as required to prevent damage resulting from ongoing or new Work.
 - 02 Provide covering protection at existing doors and frames, casework and other existing materials as required to prevent damage resulting from ongoing or new Work.
- C. Related Work:
 - 01 Section 01 50 00 Temporary Facilities and Controls

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings:
 - 01 Submit Shop Drawings delineating types and locations of all proposed floor protection surfacing.
- D. Installation Instructions:
 - 01 Submit complete installation instructions, including fastening and connection of adjacent protection surfaces, for all products and / or assemblies proposed to be furnished.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. The following manufacturers are acceptable to provide flooring protection.
 - 01 Masonite (Basis of Design)
 - 02 Floor-Defender
 - 03 Ram Board

2.2 MATERIALS

- A. Flooring Protection:

- 01 Shall be minimum 1/8" Masonite sheeting in moderate load construction traffic areas and routes.
 - 02 Shall be minimum 1/4" Masonite sheeting in heavy load construction traffic areas and routes.
 - 01 Provide a semi-permanent means of attaching adjacent sheets which will stay secure throughout the usage period.
- B. Wall Protection:
- 02 Where walls are subject to damage caused by construction traffic and / or equipment, protect using minimum 1/8" Masonite sheeting to a minimum of 48" above finish floor.
 - 03 Where walls are subject to accumulation of dust and / or other construction debris, protect with minimum 6 mil polyurethane plastic sheeting or canvas drop cloths.
 - 04 Provide a semi-permanent means of attaching adjacent sheets which will stay secure throughout the usage period.
- C. Doors and frames, casework, furniture and similar exposed existing materials shall be protected as required to prevent damage with minimum 6 mil polyurethane plastic sheeting.
- 01 Lap all seams and secure continuously as required to prevent damage.

PART 3 – EXECUTION

3.1 DOCUMENTATION

- A. Prior to the start of Work, Contractor shall provide video record of condition of existing work to remain.
- 01 The documentation shall be thorough enough to be used at the conclusion of the Work to identify whether damage or blemishes were present prior to the start of Work.
- B. Video documentation shall be used at the completion for work to confirm what if any damage is the result of Work.

3.2 FLOOR AND WALL PROTECTION

- A. Contractor shall use all necessary means required to protect existing Work to remain.
- B. Flooring Protection:
- 01 Masonite flooring protection shall be sectioned together to create a 100% covering at construction paths used to transfer equipment and materials.
 - 02 All material being stored on floors within the building shall also have Masonite floor protection.
 - 03 Classroom floors shall be minimally protected with Ram Board and / or Floor Defender products.
 - 04 Flooring protection shall be taped together with duct tape, or similar, to prevent shifting and to keep liquid substances from leaking through.
- C. Wall Protection:
- 01 In high construction traffic areas, install Masonite from finish floor to 48" above (full sheet width).
 - 02 Use a semi-permanent means of securing and maintaining Masonite in place.

- 03 Walls subject to construction debris and dust shall be covered at a minimum with plastic or cloth as required.
- D. Doors and Frames, Casework, Furniture, and Similar:
 - 01 Protection shall be at a minimum coverage with plastic or cloth; and more robust of existing Work is subject to damage.

3.3 REPAIR AND REPLACEMENT

- A. All damage and blemishes discovered at the completion of Work that is not documented on the pre-Work video record shall be deemed to be caused by the Work.
- B. Contractor shall promptly repair all damage and blemishes resulting from the construction activity.
- C. Required Remediation:
 - 01 Damaged flooring surfaces shall be replaced with the same materials.
 - 02 Damaged painted surfaces shall be touched up at a minimum; and more broadly repainted if required to blend the repainted area with adjacent surfaces.
 - 03 Damaged vinyl wall covering surfaces shall be replaced the full width of the vinyl sheet. Spot patching vinyl wall covering shall not be acceptable.
 - 04 Damaged doors and frames, casework and similar work shall be repaired to meet original condition; and where that is not achievable, shall be replaced with new materials.

END OF SECTION

SECTION 01 77 00

CLOSE-OUT PROCEDURES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Certain procedures have been developed and are required to fulfill all provisions of the Owner-Contractor Agreement with respect to contract Final Completion and Contract Close-Out for the Work / project to be 100% complete.

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. The Architect shall provide a Close-Out spreadsheet guide to the Contractor for use in monitoring progress of contract Close-Out documentation.
 - 01 The Contractor shall review the Close-Out spreadsheet guide and revise as necessary to include all Close-Out requirements.
 - 02 Coordinate with the Architect on proposed revisions and finalization of the Close-Out spreadsheet guide
- C. The Contractor shall introduce a Close-Out agenda item on the weekly / bi-weekly progress meeting agenda a minimum of 3 months prior to substantial completion date.
 - 01 Contractor shall report on contract Close-Out status and progress at each meeting.
- D. Operation and Maintenance (O&M) manuals required in the Specifications shall be submitted for review and acceptance by the A/E consultants prior to the Contractor conducting any required Owner training.
 - 01 The Contractor shall allow sufficient time for A/E review, including, but limited to A/E requirements for revisions and resubmission of O&M manuals.
- E. Close-Out documentation shall be submitted as described in this section. Refer to Part 2 and Part 3.

1.3 QUALITY ASSURANCE

- A. Completing and submitting complete and correct Close-Out documentation is the sole responsibility of the Contractor.
 - 01 Unless otherwise agreed upon by the Architect, partial submission of Close-Out documentation is not permitted.

- B. The Contractor shall use all QA / QC means necessary to assure that upon submission Close-Out documentation is complete and correct PRIOR to submission to Architect for review.
- C. Submission of Close-Out documentation shall be accompanied by Architect provided Close-Out spread sheet.
 - 01 Contractor shall submit Close-Out spreadsheet with each required item initialed by Contractor signifying each item has been verified to be complete and correct.
 - 02 Failure to submit completed Close-Out spreadsheet shall result in no review of Close-Out documentation by the Architect and return of all Close-Out documentation to the Contractor.
- D. It is not the Architect's responsibility to review incomplete and / or incorrect Close-Out documents; nor is it the Architect's responsibility to provide the Contractor a list of missing or incorrect Close-Out documents.
- E. Upon Contractor's submission of Close-Out documents / binders, the Architect shall review the submission.
 - 01 If the Architect discovers any incomplete or missing documents, the Architect's review shall promptly end without further review and the Contractor shall be notified to retrieve the documents for further action on their part to assure completeness and correctness of Close-Out documents.

PART 2 – SUBSTANTIAL COMPLETION

2.1 GENERAL

- A. Projects that involve phased sequential construction of major definable areas or projects that involve separate work on multiple campuses shall have Certificates of Substantial Completion issued for each phase or campus, as applicable and agreed upon by the Owner and Contractor.
 - 01 All conditions for Substantial Completion, including liquidated damages, shall apply for each date of Substantial Completion for each phase or campus, as applicable.
- B. Individual Substantial Completion Dates for each phase or campus shall be determined and agreed upon by the Owner, Architect and Contractor.
 - 01 Where an Alternative Proposal dictating a required, guaranteed completion date (dates) is included in the Proposal Form and accepted by the Owner, the date(s) stated therein shall establish the Substantial Completion Dates to be incorporated into the Agreement.
- C. The following items are a partial list of requirements, as applicable to the Project, which must be completed prior to establishment of a Substantial Completion date.
 - 01 All work as identified in each section of the Specifications must be 100% complete.
 - 02 Contractor's punch list, including supplementing items by A/E team and Owner must be fully documented.
 - 03 All fire alarm system components must be completed, demonstrated to the Owner and approved by the governing authority.
 - 04 Local fire marshal approval certificate must be delivered to the Owner.
 - 05 Health Department approval and certificate must be delivered to Owner.
 - 06 All HVAC air and water balancing must be complete.

- 07 All energy management systems, security and surveillance systems and low voltage systems and controls must be complete, fully operational and demonstrated to the Owner.
 - 08 All final lockset cores must be installed, and all final Owner directed keying completed.
 - 09 All room plaques and exterior signage must be complete.
 - 10 Operation and Maintenance manuals must be submitted, reviewed, accepted and delivered to Owner prior to Owner training and orientations of equipment and systems.
 - 11 All Owner demonstrations must be completed.
 - 12 A final Certificate of Occupancy must be signed by the governing authority and delivered to the Owner.
 - 13 Municipal Utility District / County approvals and compliance certificates must be delivered to the Owner.
 - 14 Scanned record drawings. Provide a full size, scanned copy of the record drawings maintained at the site in PDF format.
 - 15 All exterior clean-up and landscaping must be complete, including required stand of grass mowed and edged.
- D. Final Cleaning:
- 01 The work area shall be thoroughly cleaned inside and outside. Cleaning includes removal of smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces.
 - 02 Remove all temporary facilities.
- E. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.
- 01 Upon such acceptance and consent of surety, if any, the Owner, at his sole discretion, may make partial payment of retainage applying to such Work or designated portion thereof which is 100% complete and accepted by the Owner.
 - 02 Such payment, if made at all, shall be adjusted in the Owner's favor for Work that is incomplete or not in accordance with the requirements of the Contract Documents.
- F. The date of Substantial Completion shall represent day one (1) of the thirty (30) day period to complete all work and correct all deficiencies contained in the Punch List and the sixty (60) day period allowed for complete Contract Close-Out as described below.

2.2 PUNCH LIST

- A. Refer to Section 01 31 00 – Project Management Software for information regarding the use of project management software in development and processing the punch list.
- B. Per the Contract, a final, comprehensive punch-list is required to be attached to the Substantial Completion Certificate.
 - 01 The punch list shall be a comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be corrected, or limited items of work to be completed, if any.
 - 02 Prior to the Contractor drafting the punch list, all subcontractors should thoroughly review their work and correct the work to preclude its inclusion on a punch list.

- 03 This list is intended to represent a limited number of items needing attention.
- C. It is the Contractor's responsibility to produce the initial punch list and deliver to the Architect for supplementation.
- 01 Should the Architect determine that the Contractor's punch list lacks sufficient detail or requires extensive supplementation, the punch list will be returned to the Contractor for re-inspection and revisions.
- 02 The Architect, and Owner at his discretion, shall supplement the Contractor's punch list as necessary to be a comprehensive, complete list of all work items needing attention for Owner's final acceptance of the work.
- 03 The date of Substantial Completion will be delayed until the punch list is fully compiled and finalized by the Architect.
- D. All punch list shall be developed using Plans App, an application to describe punch list items with the ability to utilize floor plan and photo inserts to better delineate the punch list item.
- 01 Plans App is a free app to be downloaded to an iPad or similar device.
- 02 The Architect shall provide training to the Contractor for using Plans App.
- E. The information to be filled in includes the following:
- 01 Item Number: auto assigned by Plans App
- 02 Contract Document Room Number
- 03 Building Room Number
- 04 Walk-Thru Date
- 05 Author
- 06 Subcontractor Responsibility: populated by GC only
- 07 Item Category: obtained from a drop-down menu
- 08 Item Description: obtained from a drop-down menu
- 09 Comments
- 10 Subcontractor Completion Sign-Off
- 11 GC Completion Sign-Off
- 12 Architect Sign-Off
- 13 Floor Plan Insert
- 14 Photo Insert
- F. In the case of excessive repetition of the same item at various locations, the punch list may contain "general notes / items" that shall be applied to the entire project; and it shall be the responsibility of the Contractor / subcontractor to thoroughly examine the entire project and make corrective measures at all applicable locations.
- G. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion.
- 01 The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.
- 02 The Contractor is encouraged to generate unofficial, individual trade punch lists.
- H. Upon receipt of an acceptable Contractor's punch list, the Contractor's Superintendent shall accompany the Architect, his Consultants, and the Owner (at his discretion) during their observation and the preparation of their supplements to the Contractor's punch list.
- 01 The Superintendent shall record or otherwise take note of all supplementary items.

- 02 The Architect will endeavor to furnish to the Contractor typed, hand written or recorded supplements to the punch list in a prompt manner; however, any delay in the Contractor's receiving said supplements from the Architect will not be cause for a claim for additional cost or extension of time as the Contractor's Superintendent shall have been in attendance during the inspections of the Architect and his Consultants and will have been expected to take his own notes.

2.3 OPERATIONS AND MAINTENANCE OWNER DEMONSTRATIONS

- A. Refer to Section 01 78 23 – Operation and Maintenance Manuals.
- B. Specific specification sections require the Contractor to provide training to the Owner regarding proper operation and maintenance of specific products and / or assemblies.
- C. Successful completion of all Owner operation and maintenance training demonstrations is a prerequisite to achieving Substantial Completion.
- D. No Owner operation and maintenance training demonstrations shall occur prior to delivery of final, accepted operations and maintenance manuals to the Owner.
- E. Manuals shall be delivered to the Owner prior to Owner training and demonstrations to allow the Owner the benefit of having the manuals for on-site training and start-up procedures provided by the Contractor.
- F. Deliverables:
- 01 Provide one (1) electronic copy of all O&M manuals for review by the respective discipline. Deliver A/E Consultant O&M Manuals directly to the relative A/E Consultant with a copy of the transmittal to the Architect.
- 02 Resubmit as necessary to obtain final acceptance of Manuals.
- 03 Once all corrections have been made and the O&M Manuals found to be acceptable, provide one (1) hard copies of each binder and two (2) PDF format electronic copies (Thumb drives) of each binder to the Architect for transfer to the Owner. The GC shall additionally upload the O&M documents into the appropriate Projectmates folder.

2.4 SUBSTANTIAL COMPLETION SCHEDULE

- A. After the date of Substantial Completion of the project as evidenced by the Certificate of Substantial Completion, AIA document G704-2000, the Contractor will be allowed a period of thirty (30) days, unless extended by mutual agreement or provision of the Contract, within which to complete all work and correct all deficiencies contained in the Punch List attached to the Certificate of Substantial Completion. It is incumbent upon the Contractor to request Substantial Completion only when there is assurance that all work included on the Punch List shall be completed within the thirty (30) daytime frame.
- 01 In the event the Owner must take occupancy of the project prior to Contractor's completion of the punch list, the Contractor shall make all adjustments necessary to schedule the work to allow full and normal operation of the project by the Owner.
- 02 Where this requires work outside of normal business hours, the work shall be provided at no additional costs to the Owner.
- B. Upon Contractor's and sub-contractor's verification that all punch list items have been 100% completed, the Contractor shall notify the Architect and the Architect

and consultant(s) shall conduct an on-site observation to verify that all items are 100% complete.

- 01 On-site verifications for partial completions, if any, shall be conducted by the Architect at the Architect's sole discretion.
- 02 If any items shown to be complete by the Contractor are found not to be complete by the Architect, the observation shall be stopped, with such notification to the Contractor.
- 03 Contractor's requested punch list observations by the Architect shall be limited to a maximum of two (2) per punch list.

- C. If the Contractor fails to complete all work on the punch list within thirty (30) days after the Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the punch list items are completed and accepted by the Owner. During this time the Contractor will be charged from the Owner's, Architect's and any A/E Consultant's time associated with achieving completion of the punch list.

- 01 Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
- 02 The weekly meetings shall include a minimum of two (2) hours charge per participant.

- D. Owner billable time shall be deducted from the Contractor's Final Payment or separately invoiced to the Contractor at Owner's option. Owner billable hourly rates shall be as follows:

- 01 A/E Principal: \$250.00 per hour
- 02 Project Manager: \$150.00 per hour
- 03 Project Coordinator: \$125.00 per hour
- 04 Administration / Secretarial: \$80.00 per hour

- E. Architect and A/E Consultant billable time shall be invoiced to the Contractor by the Architect. A/E billable rates shall be as follows:

- 01 A/E Principal: \$250.00 per hour
- 02 A/E Project Manager: \$150.00 per hour
- 03 Staff Architect / Consultant: \$125.00 per hour
- 04 A/E Field Representative \$125.00 per hour
- 05 Administration / Secretarial: \$80.00 per hour

PART 3 – CONTRACT CLOSE-OUT

3.1 GENERAL

- A. Upon issuance of the (final) Certificate of Substantial Completion, and per the Owner-Contractor Agreement, the Contractor will be allowed a period of sixty (60) days within which to complete all Contract Close-Out requirements, unless extended by mutual agreement or provision of the Contract.
- B. In addition to all work and requirements described for Substantial Completion, to achieve Contract Close-Out, the Contractor shall submit the following Close-Out documents in 3-ring binders in the following format:
 - 01 Tab 1: Copy of executed Certificate of Substantial Completion. And copy of all final punch lists showing final approval / acceptance of each item by sub-contractor, Contractor, and Architect / Architect's Consultant.
 - 02 Tab 2: Copy of all building permits.

- 03 Tab 3: Copy of all Certificates of Occupancy and final approvals of authorities having jurisdiction.
- 04 Tab 4:
- a. Final list of sub-contractors - **alphabetical** listing. List shall contain company name, address, phone number, contact person, relative specification section number, and description of work provided.
 - b. Final list of sub-contractors - **numerical** specification section number listing. List shall contain company name, address, phone number, contact person, and description of work provided.
- 05 Tab 5:
- a. AIA G707-1994 Consent of Surety to Final Payment. Must be notarized. (Note: Architect shall provide standardized form to be used.)
 - b. AIA G706-1994 Contractor's Affidavit of Payment of Debts and Claims. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 06 Tab 6: AIA G706A-1994 Contractor's Affidavit of Release of Liens. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 07 Tab 7: Contractor's written one (1) year warranty / guarantee. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 08 Tab 8: Contractor's Affidavit of Hazardous Material. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 09 Tab 9:
- a. Finish Floor Elevation Certificate from a registered Land Surveyor; if required by the local jurisdiction having authority.
 - b. As-built survey of detention pond from a registered Land Surveyor to certify the detention pond was constructed in accordance with the permitted design; if required by the local jurisdiction having authority.
- 10 Tab 10: Subcontractors' / Material / Equipment Suppliers Affidavit of Release of Liens. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 11 Tab 11: Subcontractors' written warranty / guarantee required in excess of one (1) year. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 12 Tab 12: Subcontractors' and suppliers Affidavits stating that no asbestos or hazardous material products have been installed in this project. Must be notarized. (Note: Architect shall provide standardized form to be used.)
- 13 Tab 13: Manufacturer's written warranties to the Owner for each product / assembly / system warranty required in individual specification sections. Organize and identify each manufacturer's written warranty (top right-hand corner) by subcontractor's name - in alphabetical order; and identify with the corresponding specification section number – scope of work.
- 14 Tab 14: If asbestos abatement was performed, provide a copy of all applicable governmental forms, final test reports and certifications.
- 15 Tab 15: Owner demonstration and / or training verification. Provide sign-in sheet for all demonstrations and training sessions conducted for the Owner.
- 16 Tab 16: Extra stock verifications of product delivery to Owner.

- C. Record Drawings. Refer to section 3.4 below. Record Drawings shall be submitted separately from Close-Out binders / manuals.
- D. Owner's set of record, final submittals. Refer to section 3.5 below. Record Submittals shall be submitted separately from Close-Out binders / manuals.
- E. Final / 100% release of retainage will not be authorized by the Architect until the Contractor completes all of the requirements for Contract Close-Out; and until all expenses incurred and to be paid by the Contractor have been paid in full.
- F. It is the Contractor's sole responsibility prior to submission to verify that Close-Out documents proposed to be furnished for review and acceptance are 100% complete and accurate.
 - 01 If during review the Architect or Engineer determines the Close-Out documents are incomplete and / or inaccurate, the review shall cease and the Contractor shall be so notified to retrieve the Close-Out Documents, make corrections and resubmit.
 - 02 It is not the A/E Consultants' responsibility to return a list of missing and / or incorrect items.
- G. It is desirable and beneficial to submit all Close-Out documents as a single submission; Close-Out documents may be submitted separately in four (4) deliverables as follows:
 - 01 Close-Out Manual
 - 02 Operations and Maintenance Manuals (required prior to Substantial Completion)
 - 03 Record Drawings
 - 04 Owner's Record Copy of Submittals

3.2 CLOSE-OUT MANUAL(S) FORMAT

- A. All Close-Out documents shall be submitted in three ring binders with detailed table of contents and index tabs corresponding to the table of contents.
 - 01 Documents shall be separated by tabs as indicated in Paragraph 3.1 above.
 - 02 The Close-Out documents must be neatly organized and easily useable, as determined by the Architect and Owner.
 - 03 Each binder shall include an insert cover with the following information
 - a. Project name
 - b. Binder Title: Close-Out Manual - "description"
 - c. Architect's name
 - d. Architect's project number
 - e. Contractor's name, address and phone number
 - 04 Each binder shall include an insert in the binder spine with the following information
 - a. Project name
 - b. Binder Title: Close-Out Manual - "description"
 - 05 Inside cover page containing the following:
 - a. Project name
 - b. Contractor's address and contact information
 - c. Contractor's project manager and superintendent name and contact information.
 - d. Architect's project manager name and contact information.
 - e. Each consultant's project manager name and contact information.

- 06 Table of Contents and corresponding section tabs shall be in the same order as described in section 3.1-B above.
- 07 Provide one (1) bound copy of the Close-Out documents binder for review by the Architect. No electronic or PDF copies to be provided until final acceptance of all binders.
- 08 Resubmit as necessary to obtain final acceptance of Close-Out documents binder.
- 09 Once all corrections have been made and the Close-Out documents binder is found to be acceptable, provide final copies to the Architect for transfer to the Owner.
- 10 Number of binders required: one (1).
- 11 Number of flash drive with electronic format required: two (2).

3.3 WARRANTIES

- A. All guarantees and warranties required by the Contract Documents shall establish the date of Substantial Completion as day one (1) of the required warranty period; regardless of how long the product, assembly or work has been installed or in operation prior to Substantial Completion.
 - 01 Coordinate with subcontractors and material suppliers to account for provision in their original proposal / bid amount, if necessary.
- B. Contractor's One-Year Warranty: The Contract requires the General Contractor to warrant ALL materials and work provided / furnished for a period of one (1) year following the date of Substantial Completion.
 - 01 The one year general warranty shall include all labor, material and delivery costs required to correct defective material or installation during the Warranty period.
- C. Extended Warranties: In addition to the General Contractor's, other required guarantees and warranties in excess of one year shall be included in the Close-Out Binder in original issue form. All extended warranties shall begin on the Substantial Completion date; and shall include all labor, material and delivery costs required to correct defective material or installation. Guarantees include but are not limited to:
 - 01 Section 04 20 00 – Unit Masonry – 2 years
 - 02 Section 04 20 00 – Masonry Water Repellant – 5 years
 - 03 Section 07 52 50– Roofing – 20 years No Dollar Limit Total / Non-Prorated Systems Warranty
 - 04 Section 07 25 00 – Weather Barrier – 10 years (material / manufacturer) / 2 year labor (installer)
 - 05 Section 07 41 13 – Metal Roofing and Wall Panels – 20 years on factory finish
 - 06 Section 07 41 13 – Metal Roofing Water-tightness – 20 years
 - 07 Section 07 42 13 – Metal Wall Panels – 20 years on factory finish
 - 08 Section 07 92 00 – Sealants – 2 years
 - 09 Section 08 14 23.16 – Plastic-Faced Wood Doors – life of the doors
 - 10 Section 08 80 00 – Glazing – 5 years
 - 11 Section 09 30 13 – Ceramic Tile System – 10 years
 - 12 Section 09 68 19 – Carpeting – 15 years, life for static
 - 13 Section 09 72 13 – Digital Wall Covering – 5 years
 - 14 Section 09 91 00 – Painting – 2 years
 - 15 Section 10 44 00 – Toilet Accessories – 2 years for stainless steel finish
 - 16 Section 10 51 13 – Metal Lockers – 2 years standard lockers / 10 year athletic lockers
 - 17 Division 22 – Plumbing Systems – as specified

- 18 Division 23 – Mechanical Systems – as specified
- 19 Division 26 – Electrical Systems – as specified

3.4 RECORD DRAWINGS

- A. Upon Substantial Completion, the Contractor shall be furnished, at no charge, a complete set of electronic files in AutoCAD release 2010 or later, or Revit if applicable, of all drawings included in the Contract Documents. The title blocks shall be stripped of all logos, disclaimers and licensed seals of the Architect and Consultants.
 - 01 Applicable CTB or plot files shall be furnished by the Architect and each Consultant.
 - 02 Throughout the construction phase, Architect's and Consultant's supplemental drawings / sketches provided to the Contractor in AutoCAD or Revit format shall already be incorporated in the electronic files provided to the Contractor.
- B. Upon request, the Architect and / or Consultants shall assist the Contractor with understanding the structure and composition of the electronic files to facilitate the generation of the Record Drawings.
- C. The Contractor shall modify the title block on each / every sheet to include only the project name, project address, school district, consultants' name and address, date, and clearly identify the set as "Record Drawings".
- D. All electronic Record Drawing work shall be performed in a professional manner using AutoCAD or Revit, as applicable, and shall maintain the format / structure / composition of the original Contract Document Drawings.
- E. All modifications, additions, deletions and revisions made to the project during the construction phase shall be reflected on the Record Drawings; and shall include, but not necessarily limited to:
 - 01 All as-built dimensions (different than original dimensions)
 - 02 All as-built locations and conditions relative to underground plumbing, sanitary and storm piping installations, natural gas piping and electrical conduits; shown accurately to within twelve inches (12"). Notes shall indicate approximate depth of all underground piping and utilities.
 - 03 All as-built conditions relative to ductwork installations; shown accurately to within six inches (6").
 - 04 All as-built conditions relative to HVAC water piping installations; shown accurately to within six inches (6").
 - 05 All as-built conditions relative to underground electrical conduit installations; shown accurately to within six inches (6").
 - 06 Record drawings shall include a copy of fire sprinkler layout of piping and equipment.
 - 07 All approved CPR's resulting in a physical change in the Work.
 - 08 All RFI's resulting in a physical change in the Work.
 - 09 All AEA's resulting in a physical change in the Work.
 - 10 All Minor Changes resulting in a physical change in the Work.
 - 11 All Construction Change Directives resulting in a physical change in the Work.
 - 12 Update the list of drawings as necessary to reflect added and deleted sheets.

- F. All modifications shall be represented by actually deleting the original work and accurately depicting the revised as-built modifications / configurations. "X-ing out" deleted work shall not be accepted
- G. Provide the Record Drawings with all revision clouds and other change identifiers removed.
- H. Upon completion of all revisions to the Record Drawings, including the Architect's acceptance, the Record Drawings shall be copied to a flash drive maintaining the exact folder / file structure originally furnished to the Contractor. Submit to the Architect for review before proceeding with deliverables.
- I. Deliverables: Upon review and acceptance of the documentation, including format, the Architect shall direct the Contractor to proceed with delivery of the following:
 - 01 Two (2) flash drives containing the entire set of Record Drawings in PDF format. Each sheet shall be a separate PDF file. The electronic files shall be organized to duplicate the order of drawings as they were issued for bidding and construction, with Record Drawing modifications.
 - 02 Two (2) flash drives containing the entire set of Record Drawings in AutoCAD or Revit format as applicable. Each sheet shall be a separate AutoCAD or Revit file. The electronic files shall be organized to duplicate the order of drawings as they were issued for bidding and construction, with Record Drawing modifications.
 - 03 One (1) full-size, complete set of black-line copies on minimum 20 lb. bond paper. The set shall be plotted using the Contractor's flash drives to assure the files plot correctly. The set shall be screw-post bound.
 - 04 One (1) half-size, complete set of black-line copies on minimum 20 lb. bond paper. The set shall be plotted using the Contractor's flash drives to assure the files plot correctly. The set shall be screw-post bound.

3.5 RECORD SUBMITTALS

- A. The Contractor shall maintain and submit a separate set of final submittals to be delivered to the Owner as a condition of Contract Close-Out.
- B. Include only the final version of each submittal, including all submittal review comment sheets from the Architect and Consultant. Versions of submittals that were rejected or required to be revised and resubmitted are not required.
- C. Deliverables:
 - 01 Deliver one (1) hard copy set of Record Submittals in file boxes, organized in order by specification division, with tabs included for each section of specifications.
 - 02 Deliver two (2) copies of all Record Submittals in PDF electronic format on two (2) digital storage devices, including a copy of the Contractor's Submittal Log.

3.6 CONTRACT CLOSE-OUT SCHEDULE

- A. If the Contractor fails to complete requirements of Contract Close-Out within sixty (60) days after the actual Substantial Completion date, Contractor shall be required to attend weekly meetings at the project site or Owner's office until such time as 100% of the Close-Out documents are completed and accepted by the Owner. During this time the Contractor will be charged for the Owner's, Architect's and any A/E Consultant's time associated with achieving Final Completion.
- 01 Billable time shall include, without limitation, travel time, meeting time, document preparation, document review, and re-inspection of on-site conditions.
 - 02 The weekly meetings shall include a minimum of two (2) hours charge per participant.
- B. Owner billable time shall be deducted from the Contractor's Final Payment or separately invoiced to the Contractor at Owner's option. Owner billable hourly rates shall be as follows:
- 01 A/E Principal: \$250.00 per hour
 - 02 Project Manager: \$150.00 per hour
 - 03 Project Coordinator: \$125.00 per hour
 - 04 Administration / Secretarial: \$80.00 per hour
- C. Architect and A/E Consultant billable time shall be invoiced to the Contractor by the Architect. A/E billable rates shall be as follows:
- 01 A/E Principal: \$250.00 per hour
 - 02 A/E Project Manager: \$150.00 per hour
 - 03 Staff Architect / Consultant: \$125.00 per hour
 - 04 A/E Field Representative \$125.00 per hour
 - 05 Administration / Secretarial: \$80.00 per hour
- D. In scheduling submission(s) and final approvals of Close-Out documents, the Contractor shall allow for the following review period for each submission:
- 01 Architect: Ten (10) calendar days
 - 02 Architect's Consultant: Twelve (12) calendar days.
- E. Additionally, failure by the Contractor to complete Contract Close-Out within the stipulated time will be reported to the Contractor's surety. In the report of deficiency, the Contractor and surety will be informed that, should correction work remain incomplete for fifteen (15) additional days, the Owner at his discretion may initiate action to complete corrective work out of the remaining contract funds in accordance with the Owner-Contractor Agreement, General and Supplementary Conditions to the Agreement as they apply.
- 01 Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete Contract Close-Out within sixty (60) days after the date of Substantial Completion, unless extended by mutual agreement or provision of the contract, will be deducted from the funds remaining to be paid to the Contractor.

3.7 TERMINAL INSPECTION

- A. Approximately one (1) month prior to expiration of the one-year guarantee period, the Contractor shall notify the Architect and Owner to schedule an inspection of the work in the company of the Architect and the Owner. The Architect and the Owner shall be given not less than ten (10) days' notice prior to the anticipated date of terminal inspection.

- B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Architect and the Owner, even though the date of completion of the corrective work may extend beyond the expiration date of the guarantee period.
- C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner, nor the replacement of parts necessitated by normal wear in use.

END OF SECTION



AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety
of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)

**AIA**[®]**Document G706™ – 1994****Contractor's Affidavit of Payment of Debts and Claims****PROJECT:** *(Name and address)***ARCHITECT'S PROJECT NUMBER:**OWNER: ☐ARCHITECT: ☐CONTRACTOR: ☐SURETY: ☐OTHER: ☐**TO OWNER:** *(Name and address)***CONTRACT FOR:****CONTRACT DATED:****STATE OF:****COUNTY OF:**

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:**SUPPORTING DOCUMENTS ATTACHED HERETO:**

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment

☐ Yes ☒ No**CONTRACTOR:** *(Name and address)***BY:***(Signature of authorized representative)**(Printed name and title)*

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
		ARCHITECT: <input type="checkbox"/>
	CONTRACT FOR: General Construction	CONTRACTOR: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

*(Signature of authorized
representative)*

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

SUBCONTRACTOR / SUPPLIER AFFIDAVIT AND RELEASE OF LIEN
"Unconditional Affidavit"

STATE OF TEXAS

PROJECT: _____

COUNTY OF _____

OWNER: _____

ARCHITECT: Texas Arcadis Inc.

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____ the subcontractor/supplier who supplied, installed, and/or erected the work described below, and that, he is duly authorized to make this Subcontractor/Supplier Affidavit and Release of Lien:

Work Performed: _____

Specification Section(s): _____

2. That all work required under the subject subcontract or purchase order of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said contract which have not been paid and satisfied in full.
3. That to the best of his knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said contract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.
4. That he has received full payment of all sums due him for materials furnished and services rendered by the undersigned in connection with the performance of said contract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said contract.

ATTEST (If Corporation)

Name of Subcontractor / Supplier

Secretary _____

By _____

Date _____

Subscribed and sworn to before me on this _____ day of _____, 20_____.

Notary Public: _____

My Commission Expires: _____

GENERAL CONTRACTOR WARRANTY

STATE OF TEXAS

PROJECT: _____

COUNTY OF _____

OWNER: _____

ARCHITECT: Texas Arcadis Inc.

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____ the contractor who constructed the project referenced above, and that, he is duly authorized to make this General Contractor Warranty.
2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Architect.
4. The Contractor warrants the entire project for a period of twelve (12) months from the Date of Substantial Completion and specific sections of work for such additional periods as enumerated in the Contract Documents, except as follows:

ATTEST (If Corporation)

Name of Contractor

Secretary _____

By _____

Date _____

Subscribed and sworn to before me on this _____ day of _____, 20_____.

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR GUARANTEE/WARRANTY

STATE OF TEXAS

PROJECT: _____

COUNTY OF _____

OWNER: _____

ARCHITECT: Texas Arcadis Inc.

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____ the subcontractor who supplied, installed, and/or erected the work described below, and that, he is duly authorized to make this Subcontractor Warranty:

Work Performed: _____

Specification Section(s): _____

2. The undersigned Subcontractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.
4. The Subcontractor warrants the work performed for a period of months from the Date of Substantial Completion, except as follows.

ATTEST (If Corporation)

Name of Subcontractor

Secretary _____

By _____

Date _____

Subscribed and sworn to before me on this _____ day of _____, 20_____.

Notary Public: _____

My Commission Expires: _____

CONTRACTOR / SUPPLIER HAZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS

PROJECT: _____

COUNTY OF _____

OWNER: _____

ARCHITECT: Texas Arcadis Inc.

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____, the General Contractor who constructed or provided the sections of work described below, and that, he is duly authorized to make this Certification.

Work Performed: _____

Specification Section(s): _____

2. Do hereby certify that to the best of his information, knowledge, and belief, no asbestos, materials containing asbestos or polychlorinated biphenyl (PCB) have been used or incorporated into the Work; and that no lead or lead bearing materials have been used or incorporated into the potable water systems of the Work during the construction of the above referenced project.

ATTEST (If Corporation)

Name of General Contractor

Secretary

By

Date

Subscribed and sworn to before me on this _____ day of _____, 20_____.

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR / SUPPLIER HAZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS

PROJECT: _____

COUNTY OF _____

OWNER: _____

ARCHITECT: Texas Arcadis Inc.

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____ the subcontractor who constructed or provided the sections of work described below, and that, he is duly authorized to make this Certification:

Work Performed: _____

Specification Section(s): _____

2. Do hereby certify that to the best of his information, knowledge, and belief, no asbestos, materials containing asbestos or polychlorinated biphenyl (PCB) have been used or incorporated into the Work; and that no lead or lead bearing materials have been used or incorporated into the potable water systems of the Work during the construction of the above referenced project.

ATTEST (If Corporation)

Name of General Contractor

Secretary

By

Date

Subscribed and sworn to before me on this _____ day of _____, 20_____.

Notary Public: _____

My Commission Expires: _____

SECTION 01 78 23

OPERATING AND MAINTENANCE MANUALS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
 - 02 Instruct Owner's personnel in operation and maintenance of equipment and systems.
 - 03 Submit two (2) copies of complete manual in final form.

1.2 SUBMITTALS

- A. Initial Submittal: Submit to A/E consultant, as applicable, one (1) review / draft copy of each Operating and Maintenance Manual.
 - 01 Submit directly to the reviewing consultant (architectural, MEP, Structural, Civil, Food Service, etc.); with a copy of the transmittal delivered to the Architect.
 - 02 The A/E consultant shall return review comments or approval of each O&M manual submission within twenty-one (21) days.
- B. If a manual is deemed to be incomplete or contain errors, Contractor shall retrieve the review / draft copy and make all necessary corrections. Once complete, resubmit the complete, correct manual for A/E review.
- C. Repeat the above process as necessary to obtain final A/E approval of each O&M manual.
- D. Final Submittal: When O&M manuals have been reviewed and accepted for final printing and distribution, submit one (1) complete sets of O&M manuals to Architect; and two (2) flash drives containing PDF files of each O&M manual.
 - 01 Architect shall deliver final O&M manuals to the Owner.
- E. Final copies of O&M manuals shall contain as a minimum:
 - 01 Table of Contents for each element.
 - 02 Contractor information for each Contractor / sub-contractor.
 - 03 All submittals, Coordination Drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 04 All parts and maintenance manuals for items of equipment.
 - 05 Warranties (without starting dates)

- 06 Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
- 07 Operating and maintenance procedures.
- 08 Form of Owner's Training Program Syllabus (including times and dates).
- 09 Control operations/equipment wiring diagrams.
- 10 Schedule of filters for each item of equipment.
- 11 Schedule of belts for each item of equipment.
- 12 Other required operating and maintenance information that are complete.

1.3 QUALITY ASSURANCE

- A. It is the Contractor's / sub-contractor's responsibility to compile, review and verify that Operations and Maintenance Manuals are 100% complete and correct in accordance with the specified requirements prior to submission to the Architect / Engineer for review.
 - 01 Failure to comply with required verification may result in return of O&M manuals without a thorough A/E review.
- B. Once submitted to the Architect / Engineer for review, the A/E shall review and return any comments and revisions for correction to be incorporated into the final manuals.
- C. Schedule for Submission and Delivery:
 - 01 Submit O&M Manuals for review far enough in advance to assure completion of review(s), correction(s), publication of the final O&M manuals, and delivery to the Owner PRIOR to any Owner demonstrations / training involving equipment / systems included in the manual(s).
 - 02 No Owner demonstrations / training shall occur without final, approved O&M manuals have been delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers on front and spine.
- B. Binders shall be a minimum ring size: 1", and a maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

2.2 CONTENT

- A. Each O&M manual shall include as a minimum the following material and information:
 - 01 Table of Contents for each element, including corresponding specification number.
 - 02 Contractor information for each Contractor / sub-contractor.
 - 03 All submittals, Coordination Drawings and product data, reviewed by the Architect/Engineer; including the Architect/Engineer's stamp of

- acceptance / review comment sheets. When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.
- 04 All parts and maintenance manuals for items of equipment.
 - 05 Warranties (without starting dates)
 - 06 Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 07 Operating and maintenance procedures.
 - 08 Control operations / equipment wiring diagrams.
 - 09 Schedule of filters for each item of equipment.
 - 10 Schedule of belts for each item of equipment.
 - 11 Material Safety Data (MSD) sheets
 - 12 Other required operating and maintenance information that are complete.
- B. All material will be bound in the 3-ring binder unless otherwise agreed to by the Architect.
- 01 Sheets that are 8-12 x 14 or 11 x 17 shall be folded to an 8-1/2 x 11 format.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
- 01 Prepare data in form of an instructional manual for use by Owner's personnel.
 - 02 Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 03 Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger Drawings to size of text pages.
 - 04 Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 05 Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 06 Binder as specified.
- B. Content of Manual:
- 01 Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - i. Subcontractor or installer.
 - ii. Maintenance contractor as appropriate.
 - iii. Identify area of responsibility of each.
 - iv. Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

- 02 Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - i. Identify specific product or part installed.
 - ii. Identify data applicable to installation.
 - iii. Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
- 03 Drawings:
 - a. Supplement product data with Drawings as necessary to illustrate:
 - i. Relations of component parts of equipment and systems.
 - ii. Control and flow diagrams.
 - b. Coordinate Drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as Maintenance Drawings.
- 04 Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
- 05 Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - i. Proper procedures in event of failure.
 - ii. Instances that might affect validity of warranties or bonds.
- 06 Shop Drawings, Coordination Drawings and product data as specified.

C. Sections for Equipment and Systems:

- 01 Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - i. Function, normal operating characteristics, and limiting conditions.
 - ii. Performance curves, engineering data and tests.
 - iii. Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - i. Start up, break-in, routine and normal operating instructions.
 - ii. Regulation, control, stopping, shut down and emergency instructions.
 - iii. Summer and winter operating instructions.
 - iv. Special operating instructions.
 - c. Maintenance procedures:
 - i. Routine operations
 - ii. Guide to trouble-shooting.
 - iii. Disassembly, repair and reassembly.
 - iv. Alignment, adjusting and checking.
 - v. Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.

- g. Original manufacturer's parts list, illustrations, Assembly Drawings and diagrams required for maintenance.
 - i. Predicted life of part subject to wear.
 - ii. Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Schedule of filters for each air handling system.
 - k. Schedule of belts for each item of equipment.
 - l. Each Contractor's Coordination Drawings.
 - m. As installed color-coded piping diagrams.
 - n. Charts of valve tag number, with location and function of each valve.
 - o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - p. Other data as required under pertinent Sections of the Specifications.
- 02 Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- 03 Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
- 04 Provide complete information for products specified in Division 22.
- 05 Provide certificates of compliance as specified in each related Section.
- 06 Provide start up reports as specified in each related section.
- 07 Provide signed receipts for spare parts and material.
- 08 Provide training report and certificates.
- 09 Provide backflow preventer certified test reports.
- 10 Provide gas piping pressure test reports.

END OF SECTION

SECTION 02 32 00

GEOTECHNICAL INVESTIGATION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. The Geotechnical Investigation Report specific to this project follows this Section and is identified as:
 - 01 Entitled: Geotechnical Engineering Report
Tomball CTE Renovation
 - 02 Prepared by: Terracon Consultants, Inc.
 - 03 Project No.:
 - 04 Dated:
 - 05 Total Pages:

1.1 APPLICABILITY

- A. The Geotechnical Investigation Report is provided for proposer's general information only. Architect and Owner shall not be held responsible for accuracy of data contained in the Geotechnical Report.
 - 01 Questions or request for additional information regarding the Geotechnical Investigation Report shall be made in writing directly to the Geotechnical Lab and copied to the Architect.
- B. Prior to submission of proposals, Proposers shall visit and acquaint themselves with existing conditions and make any additional investigations they deem necessary to properly propose work and satisfy themselves as to existing subsurface conditions.
 - 01 Such investigations shall be performed only under time schedules and arrangements approved in advance by the Owner.
 - 02 Upon making on-site observations, the Proposer shall inform the Architect of any discrepancies with the Geotechnical Investigation Report and / or any concerns the Proposer has relative to existing site conditions.
- C. No additional cost will be made available to the successful proposer for work arising from his failure to examine site or subsoil conditions prior to proposing.
- D. The Geotechnical Investigation Report is not a part of the Contract Documents, but is included for Contractor's reference and use in determining specific scopes of work required for the completed project.
- E. A copy of the Geotechnical Investigation Report (XX pages) is attached to this Section.

SEE ATTACHED REPORT

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Complete all demolition work as shown on the Drawings, specified herein and required for the proper installation and interface of new work.
 - 02 The Drawings depict general demolition requirements based on existing drawings and limited field observations; but are not exhaustive.
 - 03 Visit the site and examine the existing conditions. Note all conditions as to character and extent of work involved.
 - 04 Contractor performing this work shall include in the proposal what is necessary to provide required demolition based on experience and industry standards.
- C. Related Work:
 - 01 Section 03 30 00 Cast-In-Place Concrete
 - 02 Section 04 01 20.91 Unit Masonry Restoration
 - 03 Section 04 20 00 Unit Masonry
 - 04 Electrical Sections
 - 05 Plumbing Sections

1.1 PERMITS AND ORDINANCES

- A. Procure and pay for all necessary permits or certificates required to complete the Work specified. Make any and all required notifications and comply with all applicable Federal, State and Local ordinances.
- B. Strictly adhere to all governing authorities' ordinances for proper disposal of all materials removed from the site.

PART 2 – MATERIALS

2.1 GENERAL

- A. Materials and equipment used for demolition work section shall be in accordance with industry standards and specifically suited for the task at hand.
- B. Where partial existing work is removed, and the remaining portion is designed to interface with new work, carefully cut or otherwise remove existing work as required for proper fit and finish to subsequent new work.
- C. All existing concrete to be removed shall be saw-cut as required to provide a smooth,

vertical edge to tie into new adjacent concrete.

- D. All existing masonry to be removed shall be saw-cut as required to provide a smooth, vertical edge to tie into new adjacent masonry or other work as indicated on the Drawings.
- E. All abandoned water and sewer lines shall be removed back to a concealed location and capped.
 - 01 At Slab Conditions: below slab. Cut and patch as required.
 - 02 At Drywall Partitions: behind gyp board panel. Cut and patch as required.
 - 03 At CMU Walls: behind CMU or back to CMU cavity where pipe runs in cavity. Cut and patch as required.
 - 04 At Ceiling Conditions: to above finished ceiling panel. Cut and patch as required.
- F. Field verify existing conditions and coordinate with other trades as required to include the full scope of work required.

PART 3 - EXECUTION

3.1 PROTECTIONS

- A. Prior to start of demolition work, Contractor shall provide Architect with comprehensive video documentation of existing work within and adjacent to the areas of demolition.
 - 01 Such documentation shall be used to evaluate existing work to remain to determine if any consequential / collateral damage has occurred as a result of demolition activities.
 - 02 Contractor shall make all necessary repairs and / or replacements at such damage as required to restore to original condition.
- B. Execute all demolition work in an orderly and careful manner with due consideration for any existing structures, including any part of the surrounding areas which are to remain.
 - 01 Barricade and cover as necessary to protect work to remain and adjacent areas.
 - 02 Protect any existing active service lines, indicated or not.
 - 03 Provide adequate protective covering to assure that no damage occurs to existing areas / work to remain.
- C. Avoid any encroachment on adjacent properties and Right-Of-Ways. Repair and make good any damage to adjoining properties or improvements caused by operations, including any damage or loss to adjoining materials.
- D. Keep all pedestrian areas clear for passage at all times.
- E. Conduct operations so as not to interfere with adjacent roads, streets, drives, walks, service lines and the like.

3.2 GENERAL

- A. Coordinate with other trades as required to confirm extent of demolition to be performed.
 - 01 Where over-demolition occurs, or work is removed that should have remained, make all necessary repairs and / or replacements required to

restore existing work.

- B. Backfill any trenches caused by demolition work. Refer to Section 31 23 33 – Trenching and Backfilling.
- C. Salvage of Removed Material:
 - 01 The Owner reserves the right to claim all material / equipment removed under this Contract.
 - 02 Prior to the start of demolition work, the Contractor shall contact the Owner to determine what, if any, materials and / or equipment removed are to be salvaged for Owner's retention.
- D. Disposition of Removed Material: All material removed under this Contract, which is not to be salvaged or reused, shall become the property of the Contractor and be promptly removed from the site. Do not store or permit debris to accumulate on the site.
- E. The Contractor shall review the Contract Documents as they relate to selective demolition. Items that will interfere with new work shall be removed as required to coordinate with the new work.
- F. Clean-Up: On completion of demolition work, leave property and adjacent areas clean and satisfactory to local authorities and the Architect.

3.3 EXECUTION

- A. All partial demolition at existing concrete work shall be performed by saw-cutting or removal back to a full-depth concrete joint; as required to provide a clean interface with new concrete tying into existing concrete work to remain.
- B. At areas of partial demolition, where remaining existing work is to tie into new work, conduct demolition as required to provide proper interface between existing work to remain and new work.
- C. Where existing work is shown to be removed and re-used (i.e. masonry), carefully remove such work and preserve in a condition suitable for reinstallation.

END OF SECTION

SECTION 03 15 19

BELOW SLAB VAPOR MEMBRANES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all vapor retarder membranes, vapor barrier membranes and related accessories as required forming a complete, 100% sealed membrane below building foundations.
 - 02 Coordinate Work with other trades to seal all penetrations through the slab membrane.
- C. Related Work:
 - 01 Section 01 45 23 – Testing and Inspection Services
 - 02 Section 03 30 00 – Cast-In-Place Concrete

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details.
 - 03 Show details of field fabrications, connections, and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
 - 03 Installation shall be in strict accordance with ASTM E1643.
 - 04 Provide details to be used to seal the perimeter of the vapor barriers to the foundation per ASTM E1642-11.
 - 05 Provide details to be used to seal other trade work that penetrates the slab membrane.
 - 06 Provide details to be used to seal penetrations made by temporary form stakes.
- E. Tests and Certifications:
 - 01 Summary of test results per paragraph 9.3 of ASTM E1745.

- 02 All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
 - 03 Upon completion of slab membrane installation and foundation preparation immediately prior to placement of concrete, manufacturer's rep shall inspect membrane installation and provide certification that installation is complete, and in accordance with specified requirements.
- F. Actual Samples of Proposed Materials:
- 01 Vapor retarder membrane, 8" x 10" minimum size.
 - 02 Vapor barrier membrane, 8" x 10" minimum size.
 - 03 Membrane perimeter grade beam sealing device(s).
 - 04 Joint / seam tape, 12" minimum length.
 - 05 Pre-formed penetration boot (each type).

1.2 REFERENCES

- A. American Concrete Institute (ACI):
- 01 Detailing Manual.
 - 02 ACI 302.2R-06 – Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
- B. U.S. Federal Specifications:
- 01 Fed. Spec. SS-S-158.
 - 02 Fed. Spec. SS-S-164.
- C. American Society for Testing and Materials (ASTM):
- 01 ASTM D882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - 02 ASTM D1709 – Standard Test Methods for Impact Resistance of Plastic Film by the Free Falling Dart Method.
 - 03 ASTM E154 – Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - 04 ASTM E1643 – Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
 - 05 ASTM E1745 Class A – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SITE CONDITIONS

- A. Do not proceed with membrane installation until all subgrade testing is complete and found to be in compliance with specified requirements.
- B. Subgrade Conditions:
- 01 Inspect subgrade conditions as required to confirm adequacy for installation of slab membrane work in accordance with manufacturer's standards and specified requirements.
 - 02 Verify that under-slab work of other trades is complete and does not present any conditions that may prevent the proper installation of slab membrane work in accordance with manufacturer's standards and specified requirements; or create a potential for breaching the membrane after it is installed.
 - 03 Notify Contractor of any discrepancies, deficiencies and / or issues. Do not proceed until fully resolved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS – VAPOR RETARDER MEMBRANES

- A. Under Slab Vapor Retarder Membrane: Design is based on products / systems manufactured by Stego Industries.
- B. Other acceptable manufacturers: the following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 Reef Industries.
 - 02 Sundance, Inc.

2.2 VAPOR RETARDER BELOW-SLAB MEMBRANES

- A. Design of Vapor Retarder Membrane is based on Stego Industries 15 mil Stego Wrap Vapor Barrier membrane.
 - 01 Provide all materials and accessories as specified and recommended by the manufacturer for a complete under slab membrane system.
- B. Provide vapor retarder membrane below all building slabs / foundations except areas described below to receive vapor barrier membrane.
- C. Under Slab Vapor Retarder Membrane:
 - 01 Material: manufactured from a blend of the highest quality polyolefin resins.
 - 02 Vapor Retarder / Slab Membrane shall be a manufacturer's complete system including but not limited to membrane, joint tape, penetration boots, mastic / sealant, and other accessories as supplied by the manufacturer.
 - 03 High strength, flexible, polyolefin resin based, low-permeance, geo-membrane vapor retarder system.
 - 04 Meeting or exceeding all requirements of ASTM E1745, Class A.
 - 05 Thickness: 15 mils minimum; no exceptions.
 - 06 Water Vapor Permeance rating of less than 0.01 perms as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1.2 – 7.1.5.
 - 07 Puncture Resistance: Exceeds 2,300 grams per ASTM D1709 Method B.
 - 08 Tensile Strength: Exceeds 55 PSI per ASTM D882.

2.3 OTHER VAPOR MEMBRANES MATERIALS AND ACCESSORIES

- A. Vapor Retarder Membrane Seam Tape and Perimeter Seal:
 - 01 Design is based on Stego Industries "Crete Claw" seam tape with a heavily textured top that forms a mechanical bond to the wet concrete.
 - 02 Width: minimum 6".
 - 03 High density polyethylene tape with pressure sensitive adhesive specifically formulated for use with the polyolefin membrane.
 - 04 Permeance: 0.03 maximum.
 - 05 Thickness: shall be same as membrane or thicker.
 - 06 In addition to application at membrane seams, apply tape on a maximum 10' x 10' grid throughout the membrane surface to assure consistent and complete attachment to the structural concrete foundation.
- B. Membrane Penetrations:
 - 01 All penetrations through the vapor barrier membrane shall be completely sealed.
 - 02 Methodology shall be as recommended by the manufacturer.
 - 03 Design is based on Stego Tape and Stego Mastic in accordance with manufacturer's standards and recommendations for the specific application.

- 04 Other methods (i.e. preformed boots) will be consider based on manufacturer's recommendations, subject to approval by the Architect.
- C. System Requirements:
 - 01 The vapor retarder membrane shall be a system specifically designed or suited to be applied to a structural concrete foundation where the slab is elevated above grade.
 - 02 The vapor retarder system must adhere to the underside of the foundation and remain in place after deterioration of the cardboard carton forms used to form the structural slab.
 - 03 Attachment to the structural foundation by any means that penetrate the vapor barrier membrane shall not be accepted.
 - 04 The perimeter grade beams of the structural foundation shall bear on subgrade. The system shall extend to the outside face of the grade beams and be similarly permanently attached.
- D. Accepted methods of membrane attachment to underside of structural foundation:
 - 01 Use of a seam tape and / or seam tape grid that is capable of permanently bonding with the concrete at the time it is poured (basis of design).
 - 02 Use of a membrane that has an integral fleece back designed to permanently bond with the concrete at the time it is poured.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Foundation Preparation: Verify the following is complete and acceptable prior to installation of under slab membranes:
 - 01 Foundation formwork.
 - 02 Underground work of other trades.
 - 03 All work that will penetrate the vapor membrane.
- B. Verify the area to receive under slab membranes is free from other trade work, obstructions and / or foreign objects that may puncture the membrane after installation.
 - 01 Notify Contractor of any issues and / or concerns and do not proceed until satisfactorily resolved.
- C. Drilled Piers / Plinths: Thoroughly clean concrete plinths and prepare for sealing under slab membrane to pier tops / plinths in accordance with membrane manufacturer's installation instructions.
- D. Provide a means of sealing form stakes and other temporary penetrations through the under slab membrane.
- E. VaporStakes® or other approved permanent stakes, sealed with mastic or seam tape at membrane penetration as recommended by the membrane manufacturer, and approved by the Architect.
- F. Temporary form block-out that will allow patching membrane after the stake is removed; leaving room for patching and sealing membrane.

3.2 UNDER SLAB MEMBRANE INSTALLATION

- A. Install membrane systems in strict accordance with manufacturer's recommendations and requirements, and in accordance with ASTM E1643.
 - 01 Installation shall provide a continuous, sealed membrane barrier beneath all building foundation area and below all grade beams through to the top of the exterior face.
 - 02 If / where membrane is interrupted (i.e. drilled footings, plinths, and similar), membrane shall be sealed to concrete surface per manufacturer's recommendations.
 - 03 Membrane shall extend through and up outside face of perimeter grade beams to finish grade line.
 - 04 Membrane shall be integrally and continuously attached to grade beam outside face per manufacturer's recommendations.
- B. Install Vapor Retarder membrane system below all building foundations on properly compacted structural fill pad.
- C. Lay out membrane in as full sheets as possible, minimizing the amount of joints / seams.
- D. Lap joints / seams 6" minimum and seal continuously with membrane manufacturer's system joint tape covering full laps in accordance with manufacturer's instructions.
 - 01 Clean all debris, dirt and other contaminants from membrane surfaces to receive joint tape.
- E. Penetrations by Other Trades:
 - 01 Work by other trades that penetrate membrane from subgrade to above slab shall be sealed 100% to ensure and maintain under slab barrier effectiveness.
 - 02 Provide manufacturer's tape, mastic, preformed boots or accurately cut, site fabricated membrane boots per manufacturer's instructions and recommendations.
 - 03 All penetration sealing assemblies shall above finish slab elevation a minimum of 6" and be sealed with seam tape and / or mastic to penetrating object.
 - 04 Where multiple penetrations occur in close proximity, use mastic to completely fill all voids and potential areas where water vapor could penetrate the assembly in strict accordance with manufacturer's standards recommendations.
- F. Temporary Form Penetrations:
 - 01 Where temporary forms are used to separate slab pours create slab recesses and other types of offsets, supporting stakes penetrations through the slab membrane shall be sealed 100%.
 - 02 Acceptable permanent stakes to remain in the slab are acceptable, provided they are sealed with mastic in accordance with manufacturer's installation instructions. Wood stakes are not acceptable permanent stakes.
 - 03 Where temporary stakes are removed from the finished slab, provide an acceptable means by which the hole through the membrane can be patched and sealed with membrane, seam tape and / or mastic.
 - 04 Completely fill stake voids with concrete as soon as practical while slab concrete is still plastic.
- G. Take all necessary precautions during concrete placement as required to prevent puncture of the under slab membrane.
 - 01 During concrete placement, continuously monitor / inspect the under slab membrane.
 - 02 Seal any / all membrane punctures before placement of concrete.

3.3 INSTALLATION CERTIFICATION

- A. The vapor barrier membrane manufacturer shall provide the services of a qualified representative to provide the following services:
 - 01 Inspect the building foundation / slab prep to determine it is suitable for the membrane installation to commence.
 - 02 Inspect the membrane installation during installation to confirm all requirements, standards and recommendation are being strictly adhered to.
 - 03 Inspect the final foundation prep 24 hours prior to placement of concrete to verify that the vapor membrane system is correct.
 - 04 Be present during concrete placement to observe that all requirements regarding the vapor membrane system are being adhered to.
- B. Correct all deficiencies noted by the inspector as required for his approval.
- C. Provide a letter from the manufacturer certifying the installation is complete and acceptable to proceed with placement of concrete.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all concrete and concrete accessories required for a complete installation.
 - 02 Building Foundation: Including drilled piers, grade beams, spread footings foundation walls, and / or slab on grade.
 - 03 Steel structure supported slabs.
 - 04 Site paving, curbs flatwork and sidewalks.
 - 05 HVAC equipment support structures and housekeeping pads.
 - 06 Coordinate with all other trades to confirm requirements and scope required for all associated work.
- C. Related Work:
 - 01 Section 01 22 00 – Unit Prices
 - 02 Section 01 45 23 – Testing and Inspection Services
 - 03 Section 03 15 19 – Below Slab Vapor Membrane
 - 04 Section 07 13 53 – Elastomeric Sheet Waterproofing
 - 05 Section 31 20 00 – Earth Moving
 - 06 Section 31 32 13.19 – Lime Soil Stabilization
 - 07 Section 32 13 13 – Concrete Paving and Flatwork

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Proposed mix designs for each different concrete mix proposed to be furnished, including adequate historical documentation of previous use to substantiate performance and strengths.
- D. Tests and Certifications:
 - 01 Before starting any work under this Section, make all required arrangements with the testing agency. The testing laboratory shall test and furnish certified reports on proposed cements, aggregates, mixing water and admixtures.
 - 02 Submit proposed design mixes for each type of concrete using previously tested and approved materials.
 - 03 Furnish certified reports of each proposed mix for each type of concrete.
 - 04 Proportion mixes by laboratory trial batch or field experience methods, using

- materials to be employed in the work for each class of concrete required, and report to the Architect.
- 05 Refer to Section 01 45 23 – Testing and Inspection Services for on-site procedures and testing requirements.
- 06 Furnish ready mix delivery tickets.
- E. Shop Drawings:
- 01 Shop Drawings for all reinforcing steel. Show bending diagrams, splicing and laps of rods, shapes, dimension and details of bar reinforcement and accessories.
- 02 Shop Drawings showing location of all proposed formwork construction and control joints, keying / keyways, water stops, openings, depressions, trenches, sleeves, inserts, and other items affecting reinforcement and placement of concrete.
- 03 Placement sequence schedule may be combined with Item 02.
- 04 Unless shown on the Site Plan, submit proposed layout for all expansion joints in paving, flatwork and sidewalks.
- F. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
- 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
- 02 Generic details that do not depict actual conditions shall not be acceptable.
- G. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
- 01 Include recommended cleaning products and instructions for use.
- 02 Where applicable, provide recommended maintenance schedules and procedures.
- H. Color / Finish Samples for Colored Concrete:
- 01 Provide two (2) samples of each finish for selection by the Architect.
- 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
- 03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.
- I. Actual Samples of Proposed Materials: Provide two (2) actual samples of the following products proposed to be furnished.
- 01 Plastic rebar chair supports.
- 02 Water stops.
- 03 Stains: full range of manufacturer's available color selections.

1.2 REFERENCES

- A. American Concrete Institute:
- 01 Detailing Manual.
- 02 ACI 301 – Specifications for Structural Concrete.
- B. U.S. Federal Specifications:
- 01 Fed. Spec. SS-S-158.
- 02 Fed. Spec. SS-S-164.
- C. American Society for Testing and Materials:
- 01 ASTM A1064 – Welded Steel Wire Fabric for Concrete Reinforcement.

- 02 ASTM A615 – Steel Bars for Concrete Reinforcement.
 - 03 ASTM A704 – Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 - 04 ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 05 ASTM C33-379 – Standard Specifications for Concrete Aggregates.
 - 06 ASTM C94 – Standard Specifications Ready Mix Concrete.
 - 07 ASTM C150 – Standard Specifications for Portland Cement.
 - 08 ASTM C260 – Specifications for Air Entraining Admixtures for Concrete.
 - 09 ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 10 ASTM C494 – Standard Specifications for Chemical Admixtures for Concrete.
 - 11 ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete
 - 12 ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- D. American Association of State Highway and Transportation Officials (AASHTO):
- 01 AASHTO M-213-74 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 02 AASHTO M-148 – Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
- E. Portland Cement Association: Joint Design for Concrete Highway and Street Pavement, Concrete-Typical Pavement Sections and Jointing Details.

1.3 SITE CONDITIONS

- A. Environmental Conditions:
- 01 Do not place concrete in contact with frozen earth.
 - 02 Do not commence concrete placement unless temperature is at least 35°F (2°C) and rising, or slabs until the temperature rises above 40°F.
 - 03 Discontinue concrete placement when air temperatures exceed 95°F.
 - 04 Do not place concrete during rain unless adequate protection is provided.
- B. Subgrade Conditions:
- 01 Inspect subgrade conditions as required to confirm adequacy for concrete work to proceed.
 - 02 Notify Contractor of any discrepancies, deficiencies and / or issues. Do not proceed until fully resolved.
- C. Equipment and Manpower:
- 01 Verify adequate equipment, in good working condition, is provided for all concrete pours.
 - 02 Verify adequate manpower is provided for concrete pours.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Joint Sealant:
- 01 Pecora
 - 02 BASF / Sonneborn
 - 03 Tremco
 - 04 W.R. Meadows

- B. Acceptable Manufacturers: Reinforcing Chairs:
 - 01 Dayton Aztec Castle Chairs
 - 02 OCM, Inc.
 - 03 No other substitutions.
- C. Acceptable Manufacturers: Water-stops (also refer to Structural Drawings):
 - 01 Durajoint – Seal-Tite
 - 02 Henry Company – Synko-Flex
 - 03 Vinylex Corporation – Blue Stop
- D. Acceptable Manufacturers: Curing Compound:
 - 01 Nox-Crete-Cure & Seal 100-300 E
 - 02 Shepler's – Shep-Cure 309 Rez All
 - 03 Sonneborn – Kure-N-Seal
 - 04 W.R. Meadows – Vocomp-20
- E. Acceptable Manufacturers: Concrete Color Pigment (Stain):
 - 01 Bomanite
 - 02 Davis Colors
 - 03 L.M. Scofield
 - 04 New Riverside Ochre Co., Inc.

2.2 CONCRETE MATERIALS

- A. Concrete:
 - 01 General:
 - a. Ready-mixed concrete, ASTM C94.
 - b. Comply with ACI 318.
 - c. Concrete must be approved by Architect through design mix and cylinder test of testing laboratory.
 - 02 Cement: Type 1, ASTM C150, unless approved otherwise by the Architect. Use one brand of cement for entire project.
 - 03 Aggregates:
 - a. Comply with ASTM C33. Aggregate shall be limestone at paving.
 - b. Maximum size not larger than one-fifth of the narrowest dimension between forms of the member for which concrete is to be used. Not larger than three-fourths of minimum clear spacing between reinforcing bars.
 - c. Maximum 1 ½ inches in building slabs.
 - 04 Admixtures:
 - a. Approval necessary from Architect and testing laboratory.
 - b. Use of Calcium Chloride, accelerants, or additives shall not be permitted unless there is prior written approval by the Architect and Engineer of Record.
 - c. Color Pigment: At areas indicated on drawings provide pigment at 5 pounds per 94-pound sack of cement. Follow manufacturers' recommendations.
 - 05 Strengths:
 - a. 5 sack/3000 psi/28 days: all concrete including grade beams, footings, slabs, pavements, walks.
 - b. Strength recommendations on Structural Drawings supersede when they are greater than specified here.
 - 06 Water: Drinking quality.
 - 07 Slump:
 - a. Reinforced foundation walls and footing – 5-1/2 inch max.
 - b. Slabs, beams, columns and reinforced walls – 6-inch max.

- c. Pavement – 5-1/2 inch max.
- B. Metal Reinforcing Bars:
 - 01 General: Conform to ACI Publication 315, latest edition.
 - 02 Comply with ASTM A615, Grade 60.
 - 03 #3 bars comply with ASTM A615, Grade 40.
- C. Joints:
 - 01 Construction Joint (Building Slab):
 - 02 Standard type permanent galvanized keyed contraction expansion joints, with 5 stakes per 10 feet of joint length.
 - 03 Joint may be left in place when concrete is placed on each side simultaneously. Remove when mold as edge form prior to subsequent concrete placement.
 - 04 Expansion Joint:
 - a. Fiber Joint Filler: ¾ inch thick, pre-molded asphalt impregnated rigid fiber board. Comply with AASHTO M-213-74 or redwood.
 - b. Cap sealant: Comply with Fed. Spec. TT-S-00227E "Two Component", 100% Urethane (light grey).
 - 05 Tooled Joint: Scored ¼" wide x ¼" the thickness of the concrete in depth.
 - 06 Saw-Cut Joint: 1/8" wide x ¾" to 1" deep.
- D. Waterstops – Flexible:
 - 01 Design based on Henry Company SF302 Synko-Flex Waterstop; or accepted equal.
 - 02 Asphalt based, non-hydrophilic / non-expanding waterstop.
 - 03 Continuous, flexible, moldable strip with protective wrapping.
 - 04 Size: 1" wide x ¾" deep.
- E. Waterstops – Semi-Rigid:
 - 01 Design based on BoMetals, Inc. PVC Waterstops; or accepted equal.
 - 02 The PVC waterstop shall be extruded from an elastomeric plastic material, of which the basic resin is prime, virgin polyvinyl chloride.
 - 03 The PVC compound shall not contain any scrapped or reclaimed material or pigments whatsoever.
 - 04 Provide waterstops in the shapes (i.e. dumbbell, ribbed) as indicated on the Drawings.
 - 05 Provide in sizes as required to achieve a minimum 2" embedment in each section of concrete.
 - 06 Provide thermostatically controlled Teflon covered waterstop splicing irons for field splicing as provided by BoMetals, Inc.
- F. Rebar Chairs and Spacers:
 - 01 Aztec "Castle Chair".
 - 02 OCM, Inc. – "Plastic Cradle Chair".
 - 03 Heavy-duty plastic-type sized to support all slab steel at proper height.
 - 04 Use type with sand cushion pads where concrete is on grade.
- G. Form Ties:
 - 01 Form Ties: Adjustable length and type which will not leave holes larger than 1 inch in diameter in the face of the concrete.
 - 02 Ties shall be such that when forms are removed, no metal will be within 1 inch of the finished concrete surface.
 - 03 The holes must be patched.
- H. Curing Compound: Design is based on WR Meadows VOCOMP-20; or equal by an

acceptable manufacturer.

- 01 Water based, dissipating curing compound for freshly placed concrete.
- 02 Comply with ASTM C309 Type II.
- 03 Minimum 18% solids.
- 04 Meets all VOC emission requirements.
- 05 Initially non-clear for visual verification of adequate coverage.

- I. Cardboard Carton Void Forms: Permitted only if specifically indicated on the Drawings.
 - 01 Wax impregnated, trapezoidal shape.
 - 02 Use only if / where indicated on the Structural Drawings.

2.3 COLORED CONCRETE

- A. Design of colored concrete is based on products / systems manufactured by Bomanite.
- B. Field Colored Concrete: Equal to Bomanite "Color Hardener" system – Heavy Duty Grade for high wear resistance.
 - 01 A blend of mineral oxide pigments, cement and graded silica aggregates applied to freshly placed concrete as recommended by the manufacturer.
 - 02 Color as selected by Architect from full range of manufacturer's colors.
 - 03 Provide at all ramps as required by Americans with Disabilities Act and Texas Department of Licensing and Registration "Texas Accessibility Standards".
 - 04 Provide at all areas designated "Colored Concrete".
- C. Batch Plant Colored Concrete: Equal to Bomanite "Integral Color" color admixture system.
 - 01 Comprised of high-quality pigments and other ingredient designed to enhance the color and pigment dispersion, workability and finishing performance of the concrete.
 - 02 Integral Coloring Admixture: Bomanite Integral Color synthetic oxide pigment meeting requirements of ASTM C979 and C494; in type as recommended by the manufacturer for the specific application.
 - 03 Integral color shall be added to concrete at the batch plant as recommended by the manufacturer.
 - 04 Once mixed, no water shall be added to the design mix to maintain quality and consistency of the color.
 - 05 Color as selected by Architect from full range of manufacturer's colors.
 - 06 Provide at all areas designated "Colored Concrete".
- D. Sealing and Finishing Coat: Equal to Bomanite "Hydroblock".

2.4 SLAB MEMBRANES

- A. Refer to Section 03 15 19 – Below Slab Vapor Membranes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General:
 - 01 Clean all mixing and transportation equipment; remove debris from forms; wet forms thoroughly; remove ice or other coatings from reinforcement which might hinder good bond; remove water from place of deposit; and check

reinforcement.

- B. Accessories:
 - 01 Install anchor bolts, slots, dove-tail anchor slots, boxes, sleeves and other required devices. Provide all such items not specified to be provided by other trades.
 - 02 Provide temporary supports to maintain accessory location / position during concrete placement and initial finishing. Remove temporary supports as required.
- C. Coordination:
 - 01 Unless specifically shown or allowed in other Specification Sections and / or Drawings, no horizontal runs of conduit, piping or other work shall be allowed within the slab.
 - 02 All underground conduit runs (if allowed) shall be trenched / installed within the building pad, a minimum 6" below the slab. Refer to Electrical Drawings and Specifications.
 - 03 Exception to 02: Only conduit runs to floor mounted or recessed receptacles at finish floor may be installed above the slab membrane provided all following conditions are met:
 - a. 3/4" maximum conduit size allowed provided the conduit is recessed below the slab thickness indicated.
 - b. Length of conduit run is minimized to turn up at the nearest available building component (partition, furring, etc.) to allow conduit to be concealed above the slab.
 - c. Such installations are not specifically excluded in other Sections or the Drawings.
 - 04 All penetrations through concrete grade beams and elevated beams shall be sleeved.
 - 05 Coordinate with other Contractors / trades as required for proper installation of interfacing work; and monitoring of such work during placement and finishing of concrete. All interfacing work displaced during concrete placement will be required to be moved to proper location.
- D. Subgrade:
 - 01 Prior to placement of slab membrane, inspect the building pad / subgrade and verify that all foreign objects have been removed.
 - 02 Verify that the subgrade is level, compacted and evenly graded. Hand rake where required.
 - 03 Remove all material that could potentially puncture or stress the slab membrane.
- A. Forms:
 - 01 Conform to the shapes, lines and dimensions of the members as shown on the drawings, except as modified under Section 31 20 00 – Earth Moving of these Specifications.
 - 02 Care shall be taken to assure that formwork does not stain concrete surfaces.
 - 03 Slab Block-Outs:
 - a. Diamond configuration at paving drains and building slabs.
 - b. Coordinate with concrete joints, verify with Architect.
 - 04 Slope exterior concrete slabs away from building and slope interior slabs to floor drains. Verify all slopes with Architect prior to start of concreting.
 - 05 Forms:
 - a. Grade beams shall be formed to the sizes indicated on the Drawings.
 - b. Where carton forms are not required, the contractor may omit forms of grade beams provided the grade beam is widened 1 1/2 inches on

- each side in contact with the earth.
 - c. The top 12 inches (minimum) of the outside faces of exposed perimeter grade beams must be formed. Unformed perimeter grade beams shall not be allowed above the surface of finish grading.
 - d. If forms are used, then the widening of the grade beams are not required.
 - 06 Carton Forms: Permitted only if specifically indicated on the Drawings.
 - a. Where carton forms are required, both sides of the grade beam shall be formed.
 - b. Fasten carton form in place to eliminate movement / shifting during concrete placement.
 - c. Take all necessary precautions to keep carton forms dry prior to concrete placement. In the event they become wet, remove and replace with dry, rigid forms.
 - 07 Slab Recesses and Sloped Surfaces:
 - a. Accurately form all slab recesses to depths indicated on the Drawings.
 - b. Where Drawings indicate slab(s) to slope, accurately form sloped areas and screed to provide a uniform slope.
 - c. Contractor shall have the option to form recessed and sloped areas a minimum of 2 inches deeper than indicated and top-out recess at a later date to finished elevations.
 - 08 Form Removal:
 - a. Ensure safety of the structure.
 - b. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to support their weight and the load thereon.
- B. Vapor Membrane:
 - 01 Refer to Section 03 15 19 – Below Slab Vapor Membrane.
 - 02 Verify that vapor membrane installation is 100% complete and approved prior to start of reinforcement installation and / or slab prep work.
 - 03 Immediately repair and / or replace vapor membrane if damaged during concrete work preparation or placement.
- C. Reinforcing:
 - 01 Cleaning Reinforcement: Free from rust, scale or other coatings which will destroy or reduce the bond.
 - 02 Placing Reinforcement:
 - a. Place accurately and adequately secure in position.
 - b. Reinforcement in all concrete slabs shall be held in proper locations by use of plastic chairs spaced a maximum distance of 48 inches O.C., unless noted otherwise.
 - 03 Coverage of Reinforcement: The metal reinforcement shall be protected by the thickness of concrete indicated on the plans.
 - a. 3-inch: Concrete deposited against ground without use of forms.
 - b. 2-inch: Bars more than 5/8 inch diameter where concrete is exposed to the weather, or exposed to the ground but placed in forms.
 - c. 1-1/2 inch: Bars 5/8 inch diameter where concrete is exposed to the weather, or exposed to the ground but placed in forms.
 - d. 3/4 to 1 inch: In slabs and walks not exposed to the ground nor to the weather, not less than 3/4 inch. Increase coverage and slab thickness at auditorium seating to miss seat anchors. Refer to Structural Drawings.
 - e. Not less than 1 1/2 inches in beams, girders and columns not exposed to the ground nor to the weather.

- f. 1-1/2 to 1-3/4 inches from top: Paving.
 - 04 Mesh: Locate as shown on the Drawings. Place on chairs. During concrete placement, verify that mesh is pulled up into concrete pour.
- D. Waterstops:
 - 01 All non-rigid waterstops shall be installed in a continuous keyway cast into the (receiving) concrete. Keyways shall be formed with 2x4's with canted sides to form a trapezoid shape.
 - 02 Concrete to receive waterstops shall be dry and free of contaminants.
 - 03 Where required, prime concrete in accordance with manufacturer's standards and recommendations.
 - 04 Install waterstops in continuous lengths, firmly adhered to receiving concrete surface.
 - 05 Overlap at splice joints in accordance with manufacturer's standards and recommendations.
 - 06 Leave protective wrapping in place until ready to cover with fresh concrete.
- E. Joints:
 - 01 Construction Joints:
 - a. Floor slabs shall be formed using metal screed joints. Verify locations of all control joints not indicated on the Drawings with the Architect, in ample time to avoid construction delay.
 - b. Use at cold joints in building.
 - 02 Contraction Joints: Refer to Structural Drawings.
 - 03 Expansion Joints:
 - a. Where walks and paving terminates against curbs or buildings, and at sides adjacent to curbs building or walls, whether detailed or not. Verify locations with the Architect if either redwood or asphalt impregnated fiber with sealant cap.
 - 04 Tooled Joints: Provide scored lines on exterior concrete slabs and walks.
- F. Concrete:
 - 01 Batching, Mixing and Delivery Equipment: Use transit mixed concrete from approved batching and mixing plant. Batch, mix and transport concrete to the site in accordance with provisions of ASTM C94.
 - 02 Inspection: Examine all areas and conditions under which the Work of this Section will be performed. Correct any conditions detrimental to the approved completion of the Work. Do not proceed until all such conditions are corrected.
 - 03 Concrete Placement (general):
 - a. Place concrete in compliance with practices and recommendations of ACI-304, and as specified herein.
 - b. Do not deposit concrete on concrete which has hardened sufficiently to form seams or planes of weakness within the section.
 - c. Where a section cannot be placed continuously, provide construction joints.
 - d. Place concrete at such a rate that concrete which is being integrated with fresh concrete is still plastic.
 - e. Deposit concrete as nearly as practicable in its final location to avoid segregation due to re-handling and flowing. Do not subject concrete to any procedure which might cause segregation.
 - f. Screed concrete which is to receive other construction to the proper level, to avoid excessive skimming and grouting.
 - g. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials.

- 04 Placement Schedule: Place concrete in conformance with a placement schedule to ensure even distribution of loads.
- Alternate placement to allow for shrinkage.
 - Where construction joints are shown or required, alternate panels, allowing a minimum of 7 days curing time prior to placing adjacent panels.
- 05 Conveying:
- Handle concrete from point of delivery and transfer to conveying equipment to the location of final deposit as rapidly as practicable, and by methods which prevent segregation and loss of mix materials.
 - Provide runways for wheeled conveying equipment from delivery point to location of final deposit.
 - Keep interior surfaces of conveying equipment, including chutes and tremies, free from hardened concrete, debris, water and other deleterious materials.
 - Pumps may be used only if they can pump the designed mix. Do not add fine aggregate or water to the mix to satisfy needs of a pumping device.
 - Use chutes or tremies for placing concrete where a drop of 10'-0" or more is required.
- 06 Slab Placement:
- Moisten subgrade the evening before and immediately prior to placement of all paving slabs.
 - Deposit and consolidate concrete slabs in a continuous operation, within the limits of any construction joints, until the placing of a panel or section is completed.
 - Consolidate concrete during placement by use of the specified equipment, thoroughly working concrete around reinforcement and into corners.
 - Consolidate concrete placed in beams and girders of supported slabs and against bulkhead of slabs on grade, as specified for formed concrete structures.
 - Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds or other methods acceptable to the Architect.
 - Limit time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.
 - Bring slab surfaces to correct level with a straight edge, and then strike off.
 - Use bull-floats or darbies to smooth the surface, leaving it free from bumps and hollows.
 - Do not sprinkle water on the plastic surface; do not disturb the slab surfaces prior to start of finishing operations.
- 07 Cold Weather Placing: Comply with ACI-306 to protect all concrete work from physical damage and reduce strength caused by frost, freezing actions, or low temperatures. Place no concrete against frozen earth.
- Use of Calcium Chloride, accelerants, or additives shall not be permitted unless there is prior written approval by the Architect and Engineer of Record.
- 08 Hot Weather Placing: Prepare aggregates, mix water and other ingredients, and place, cure, and protect concrete in accordance with the requirements of ACI-305.
- 09 Consolidation:
- Consolidate all concrete footings, piers, grade beams, slabs, paving, etc. in accordance with provisions of ACI-309.
 - Consolidate each layer of concrete immediately after placing, using

- internal concrete vibrators supplemented by hand-spading, rodding or tamping.
 - c. During all phases of operation, maintain a frequency of not less than 10,000 vibrations per minute per internal vibrator.
 - d. Provide adequate number of units and power source at all times. Maintain spare units on hand to ensure adequacy.
 - e. If, in the opinion of the Architect, the equipment is not adequate to accomplish proper consolidation, he may order delay in further placement until adequate equipment is made available.
 - f. Maintain vibrators to assure peak efficiency at all times during placement.
- G. Colored Concrete – Color Hardener:
 - 01 While concrete is still in the plastic stage of set, apply Bomanite Color Hardener
 - 02 Apply at rate recommended by manufacturer, evenly to the surface of the fresh concrete by the dry-shake method.
 - 03 Apply in two or more shakes, floated after each shake and troweled only after the final floating.
 - 04 Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
 - 05 Apply secondary stain treatment per approved mock-up or as scheduled to achieve design.
 - 06 Apply finish sealer per approved mock-up or as specified to achieve design required.
 - 07 Apply Bomanite recommended Colorwax in accordance with manufacturer's printed instructions in colors to match the colored concrete selected.
- H. Wet Curing:
 - 01 All interior slab areas shall be water cured for a minimum of five (5) days.
 - 02 Maintain wetness of slab areas by suitable means (sprinklers, drip hoses, water blankets, etc.) for a minimum of five (5) days.
- I. Curing Compound: Concrete work cured with a curing compound shall be performed in strict accordance with the manufacturer's requirements and recommendations.

3.2 FINISHES AND TOLERANCES

- A. Finishes – Grade Beams and Vertical Surfaces:
 - 01 Exposed surfaces of all concrete walls and grade beams shall receive a rubbed finish, unless otherwise noted. Immediately after forms are removed, grout pits and recesses and rub with carborundum stone to a smooth finish, free from marks or honeycomb to the Architect's satisfaction. Finish exterior surface 2 inches below finish grade.
 - 02 Rubbed finish shall be of the finest workmanship, with uniform texture and color.
 - 03 Prepare samples for approval of Architect.
 - 04 Protect all rubbed finish against damage during construction period. Immediately before requesting final acceptance of work, the Contractor shall remove protection and do such touch up and rubbing as necessary to leave rubbed surfaces in perfect condition.
 - 05 Miscellaneous Vertical Surfaces: Finish all vertical surfaces, including but not limited to curbs, risers, low walls and stringer, while concrete is strong enough to stay in place without forms yet green and able to be finished to a homogeneous appearance.

- B. Finishes – Interior Slabs:
- 01 Spreading of dry cement for finishing is not permitted.
 - 02 Flooding floor is not permitted during finishing. A limited, light / sprinkled application of water shall be permitted.
 - 03 Interior slabs to receive direct applied finish flooring: provide a troweled smooth flat matte finish capable allowing moisture within the slab to escape through capillary pores of the concrete surface.
 - 04 Interior slabs to remain concrete: Provide a smooth, hard troweled finish.
 - 05 Moisture mitigation required due to over troweling concrete slabs to the point that moisture is trapped within the concrete slab shall be at the Contractor's sole risk and responsibility; and shall not be at any additional cost to the Owner.
 - 06 Interior slabs to receive thickset / mud-bed finish flooring (mud-set terrazzo, thick-set quarry tile, etc.): floated, smooth finish. Coordinate exact requirements with flooring applicator.
- C. Saw-Cut Joints in Slabs:
- 01 All joints to be saw-cut in slabs shall occur within six (6) hours of concrete placement.
 - 02 All joints cut into green slabs shall be cut with an early entry saw specifically designed for cutting green concrete.

3.3 FIELD QUALITY CONTROL

- A. Testing Laboratory: Perform the appropriate tests upon notification by the Contractor. Refer to Section 01 45 23 - Testing and Inspection Services.
- B. Contractor shall take necessary precautions to not over-trowel concrete slabs to the point that the finish closes pores in the concrete.
- C. Tolerances – Interior Slabs at Finish Floor to Receive Adhered Flooring Materials:
- 01 True to plane within 3/16" over any 10-foot length, non-cumulative; ACI F-32.
 - 02 Verify any additional requirements with the flooring installer.
- D. Tolerances – Recessed Interior Slabs to Receive Composite Wood Flooring Assemblies:
- 01 True to plane within 1/8" over any 10-foot length, non-cumulative; ACI F-50.
 - 02 Verify any additional requirements with the flooring installer.
- E. Tolerances – Recessed Interior Slabs to Receive Built-Up or Thick-Set Flooring:
- 01 True to plane within 5/16" over any 10-foot length, non-cumulative; ACI F-20.
 - 02 Verify any additional requirements with the surfacing installer.
- F. Exterior Concrete Slabs: Refer to Section 32 13 13 – Concrete Paving and Flatwork.

3.4 PATCHING AND CLEANING

- A. After forms are removed, remove projecting fins, bolts, form ties, nails, etc., not necessary for the work, or cut back 1 inch from the surface. Where, in the Architect's opinion, surface defects occur, such as honeycombing, repair the defective areas as directed by the Architect. Joint marks and fins in exposed work shall be smoothed off and cleaned as directed by the Architect.
- B. Repair defects in concrete work per ACI-301, Chapter 9, and as directed by the Architect. Chip voids and stone pockets to a depth of 1 inch or more as required to remove all loose material. Voids, surface irregularities, chipped areas, etc., shall be

filled by patching, gunite or rubbing, as directed by the Architect. Repaired surfaces shall duplicate appearance of unpatched work.

- C. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete to the approval of the Architect.
- D. Reinforce or replace any deficient work as directed by the Architect, and at no additional cost to the Owner.

3.5 CLEAN - UP

- A. In addition to the requirements of General Conditions, clean up all concrete and cement work on completion of this portion of the work, except protective coating or building papers shall remain until floors have completely cured or until interior partitions are to be installed.

END OF SECTION

SECTION 04 01 20.91

UNIT MASONRY RESTORATION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Extent of masonry restoration work is indicated on Drawings and photos.
 - 02 Repointing mortar joints where shown.
 - 03 brick cleaning all surfaces.
 - 04 brick sealing all surfaces.
 - 05 Caulking of cut stone and masonry joints
 - 06 Final cleaning.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 07 92 00 – Joint Sealants

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's technical data for each product proposed to be furnished including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Provide shop drawings indicating all areas of masonry restoration and action(s) proposed to be implemented at each location.
 - 02 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Samples: Submit, for verification purposes, samples of the following:

- 01 Each new exposed masonry mortar to be used for replacing existing materials. Include in each set of samples the full range of colors and textures to be expected in completed work.
- 02 Each type of chemical cleaning material data.
- 03 Each type of chemical clear sealer manufacturer's product data.
- 04 Stone masonry patching materials product data and application instructions.

F. Repointing Mock-Up:

- 01 Prepare 2 separate sample areas of approximately 2 feet high by 2 feet wide for each type of repointing required, one for demonstrating methods and quality of workmanship expected in removal of mortar from joints and the other for demonstrating quality of materials and workmanship expected in pointing mortar joints appearance to adjacent existing joints.
- 02 The intent of the new pointing work is to match cleaned existing mortar.
- 03 Newly pointed areas shall be consistent with existing adjacent mortar joints for color and texture.
- 04 Once accepted, the mock-up area shall set the minimum standard for all subsequent work.

1.3 REFERENCES

A. ASTM International

- 01 ASTM C141 – Standard Specification for Hydrated Hydraulic Lime for Structural Purposes
- 02 ASTM C144 – Standard Specification for Aggregate for Masonry Mortar
- 03 ASTM C150 - Standard Specification for Portland Cement
- 04 ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes

1.4 QUALITY ASSURANCE

A. Restoration Specialist: Work must be performed by a company having not less than five (5) years of successful experience in comparable masonry restoration projects and employing personnel skilled in the restoration processes and operations indicated.

B. Project Conditions:

- 01 Do not repoint mortar joints or repair masonry unless air temperatures are between 40°F and 80°F and will remain so for at least 48 hours after completion of work.
- 02 Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.
- 03 Protect sills, ledges and projections from mortar droppings.

1.5 SEQUENCING AND SCHEDULING

A. Perform masonry restoration work in the following sequence:

- 01 Chemically clean brick, cut stone and rough-cut stone masonry.
- 02 Rake out existing mortar from joints indicated to be repointed.
- 03 Repoint existing mortar joints of masonry indicated to be restored.
- 04 Chemically seal brick, cut stone and rough-cut stone masonry.
- 05 Caulk stone joints specified under Section 07 92 00 – Joint Sealants.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

- A. Mortar materials:
 - 01 Portland Cement: ASTM C150, Type I.
 - 02 Hydrated Lime: ASTM C207, Type S.
 - 03 Colored Mortar Aggregate: Natural or manufactured sand selected to produce mortar color to match adjacent existing mortar color.
 - 04 For pointing mortar provide sand with rounded edges.
 - 05 Match size, texture and gradation of existing mortar as closely as possible.
 - 06 Colored Mortar Pigment: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with record of satisfactory performance in masonry mortars.
 - 07 Water: Clean, free of oils, acids, alkalis and organic matter.

2.2 CLEANING MATERIALS AND EQUIPMENT

- A. Masonry and stone cleaning materials are based on products manufactured by ProSoCo.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided all proposed products meet or exceed the specified requirements.
 - 01 Diedrich Technologies
 - 02 Sika Corporation
 - 03 Thuro
- C. Materials: The specified cleaning application is a three (3) step process requiring all of the following products. ProSoCo Sure Klean products are used as a standard. Equal products for each application by Sika or Thuro are acceptable for cut stone and rough-cut rubble stone.
- D. For Cut stone and rough-cut stone masonry:
 - 01 First application, Sure Klean 766 Limestone and Masonry Prewash.
 - 02 Second application, Sure Klean Limestone and Masonry Afterwash.
 - 03 Third Application, Sure Klean Weather Seal Siloxane PD Natural Stone Treatment.
- E. For Brick Masonry:
 - 01 ProSoCo Sure Klean Restoration Cleaner.
- F. For spot problem stains where required:
 - 01 Product: Subject to compliance with requirements, provide "Sure Klean Limestone Restorer", ProSoCo, Inc.
- G. Water for Cleaning:
 - 01 Clean, potable, free of oils, acids, alkalis, salts, and organic matter.
 - 02 Warm Water: Heat water to temperature of 140°F to 180°F (60°C to 82°C).
- H. Brushes: Fiber bristles only.

- I. Spray Equipment: Provide equipment for controlled spray application of water and chemical cleaners, if any, at rates indicated for pressure, measured at spray tip, and for volume.
 - 01 For spray application of chemical cleaners, provide low pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with cone shaped spray tip.
 - 02 For spray application of water, provide fan shaped spray tip which disperses water at angle of not less than 15 degrees.

2.3 POINT MORTAR MIXES

- J. General:
 - 01 Measurement and Mixing: Measure cementitious and aggregate material in a dry condition by volume or equivalent weight. Do not measure by shovel, use known measure. Mix materials in a clean mechanical batch mixer.
 - 02 Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix, which will retain its form when, pressed into a ball. Maintain mortar in this dampened condition for 1 to 2 hours. Add remaining water in small portions until mortar of desired consistency is reached. Use mortar within 30 minutes of final mixing; do not re-temper or use partially hardened material.
 - 03 Colored Mortar: Produce mortar of color required by use of selected ingredients. Do not adjust proportions without Architect's approval.

2.4 POINTING MORTAR FOR ROUGH CUT STONE

- A. One-part white Portland cement, 1-part lime, 6-parts colored mortar aggregate.
- B. Rough cut stone is to have square ribbon mortar joint to match existing profile.

2.5 CHEMICAL SEALERS

- A. Chemical penetrating sealer is for brick, cut stone and rough-cut stone. It is to be one of the following:
 - 01 ProsoCo Siloxane PD
 - 02 Sika Corporation Silane/ Siloxane water repellent
 - 03 Throro Silane/siloxane water repellent

2.6 EQUIPMENT

- A. Pressure cleaning equipment shall be standard products specially manufactured for the intended purpose, which use a mixture of water and cleansing agent or water only, applied under pressure to adequately clean the types of surfaces scheduled. If cleansing agents are used, they shall be of the best type for the intended purpose, subject to compliance with applicable standards and regulations of the EPA and OSHA. Use of cleansing agents is optional with the Contractor; however, no additional cost will be allowed for the Contractor's use of such cleansing agents. Pressure cleaning equipment shall be capable of operating within a range of working pressures between a minimum of 100 psi and a maximum of 10,000 psi and shall be capable of maintaining a minimum of 1200 psi at a minimum of 300 feet above the pump. With the exception of the water supply, this equipment shall be self-contained with an integral power supply and shall include all accessories required for the

cleansing operations as recommended by the equipment manufacturers. Use of sand or other abrasive materials in the washing solution will not be permitted. Nozzle design shall permit aeration of the water stream to break up the force of the stream.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protection of the public and users of the buildings will be the responsibility of the Contractor and will be accomplished by suitable barriers, barricades, signs and other devices as required by the conditions encountered at each building, and as approved by the Contracting Officer.

3.2 CLEANING OF SURFACES

- A. All existing brick, concrete, stucco and masonry surfaces indicated on the Plans to be cleaned/restored shall be water pressure cleaned to remove any erosion or soil which is embedded in these deformations. Likewise, the existing lime soil imbedded in the surface configurations. Vary direction of the cleaning spray due to the surface texture of the face brick, masonry, and plaster used on the structures to be cleaned. Vary the amount of pressure used on the different materials and it shall be the Contractor's responsibility to determine the proper pressure necessary for cleaning each material without damaging its surface.

3.3 OPERATION OF THE PRESSURE CLEANING EQUIPMENT

- A. Operation of the pressure cleaning equipment will be in accordance with equipment manufacturer's printed instructions subject to compliance with applicable Federal and Texas Laws, standards and regulations. Operators shall be skilled in the operation of this type of equipment. Working pressures shall be the best pressures for the intended operation, as determined by the test patterns, and shall be carefully controlled to prevent damage to adjacent construction and finishes. Window and door openings, cracks, holes, etc. shall be adequately protected against infiltration of the washing solution. Damages to construction and finishes caused by negligent operation of this equipment shall be patched and repaired/restored to their original or better condition by the Contractor at no additional cost. All vegetation shall be adequately protected to avoid damage. If any vegetation around the building is damaged or killed due to the construction process, they shall be replaced by the Contractor.

3.4 RESIDUE OF CLEANSING AGENTS

- A. Residue of cleansing agents shall be removed from the glass surfaces, etc. if they leave a film, and surfaces to be painted.

PART 4 - PROCEDURES

4.1 SCHEDULING

- A. Scheduling will be as approved by the Architect. All structures designed to be cleaned are used daily and this will not be interrupted by this Contract. It will be the responsibility of the Contractor to schedule his work around entrances as

an example, during those times when the least amount of usage will be required.

END OF SECTION

SECTION 04 05 23

CONCEALED MASONRY LINTEL SYSTEM

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all engineered, concealed masonry lintel systems where indicated on the Drawings and as required for a complete installation and support of masonry arched and plat spans.
 - 02 Provide all engineering, design and fabrication of the supporting lintel assemblies.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry

1.2 SUBMITTALS

- A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details.
 - 03 Show details of field fabrications, connections, and details.
 - 04 Provide engineering calculations used to design and fabricate the assemblies.
 - 05 Engineered shop drawings shall be sealed and signed by a Texas registered structural engineer.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including assembly and fastening for all products and / or lintel assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface with the adjacent work and assemblies indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
 - 02 ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 03 ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 04 ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.
 - 05 ASTM B633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 - 06 ASTM F568M – Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners.
 - 07 ASTM F738M – Standard Specification for Stainless Steel Metric Bolts, Screws, and Studs.
- B. American Welding Society (AWS)
 - 01 AWS B2.1/B2.1M – Specification for Welding Procedure and Performance Qualification.
 - 02 AWS D1.1/D1.1M – Structural Welding Code – Steel.

1.4 COORDINATION

- A. Coordinate with the structural engineer and steel fabricator / supplier as required for proper interface and attachment to structural steel supporting assemblies.
- B. Coordinate with the masonry subcontractor to ensure proper sequencing of masonry installation related to installation of the concealed masonry lintel system.

1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 01 Minimum of 5 years of experience in manufacture of the adjustable concealed lintel system for masonry.
 - 02 Minimum of 5 years of experience in projects of similar scope.
 - 03 Manufacture in accordance with established quality assurance program.
- B. Manufacturer shall provide capable field service representation during installation.
 - 01 Field representative shall be thoroughly familiar with the installation of adjustable concealed lintel system; as well as, the specific requirements of the essential work of this project.

1.6 DELIVERY, STORAGE AND PROTECTION

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage and Handling Requirements:
 - 01 Store and handle materials in accordance with manufacturer's instructions.
 - 02 Keep materials in manufacturer's original, unopened containers and packaging until installation.

- 03 Store materials in clean, dry area indoors.
- 04 Protect materials and finish during storage, handling, and installation to prevent damage.

1.7 SITE CONDITIONS

- A. Cold Weather Protection: No masonry shall be laid when the temperature of the outside air is below 40°F, unless protection measures are employed and pre-approved by the Architect.
- B. Protection measures for cold weather erection include maintaining space and masonry unit temperatures of at least 40°F for 48 hours, prior to and after erection.

1.8 WARRANTY

- A. Warrant the adjustable concealed lintel system work specified herein for a minimum of two (2) years after Substantial Completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to the following:
 - 01 Noticeable deterioration of masonry unit or mortar joints.
 - 02 Discoloration of the masonry or mortar joints resulting from the adjustable concealed lintel system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of adjustable concealed lintel systems is based on products manufactured by Halfen USA, Inc.
- B. Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - 01 Hohmann & Barnard

2.2 DESIGN CRITERIA

- A. The concealed masonry lintels systems shall be designed to be supported by or suspended from structural steel framing as coordinated with the project structural engineer.
- B. The concealed masonry lintels systems shall be designed to comply with, and withstand the specified wind loads for the project.
- C. Span lengths and radiuses, if any, shall be as indicated on the Drawings.
 - 01 Additional masonry load beings supported by the concealed masonry lintels systems above the arches shall be as indicated on the Drawings.
 - 02 Design of the concealed masonry lintels systems shall properly interface with adjacent, non-lintel masonry work as indicated on the Drawings.

2.3 MATERIALS

- A. Design of adjustable concealed lintel systems is based on Halfen USA, Inc. Adjustable Concealed Lintels System for Masonry
 - 01 Design is based on the Halfen Channel and Bracket Design system capable of spanning in excess of 8'-0", designed for a multi-course base at masonry arch.
- B. All components, including support channels, brackets and stitching rods, shall be fabricated from ASTM A36 structural steel, hot-dipped galvanized after fabrication in accordance with ASTM A123 or A153 as applicable.
- C. Fasteners:
 - 01 Bolt Type Fasteners: stainless steel in accordance with ASTM A276.
 - 02 Bolt sizing, length and spacing as engineered by the manufacturer.
 - 03 Nuts and washers shall be stainless steel in accordance with ASTM A276.
- D. System shall be complete including all components and accessories required to properly interface with supporting building structure and non-lintel, adjacent masonry assemblies.

2.4 FABRICATION

- A. Fabricate components to design required and provide for site-required adjustments.
- B. Components that interface directly with masonry forming the lintel shall be fabricated to allow for minimum 3/4" deep mortar joints when interfaced with support brackets.
- C. Weld and grind components flush and smooth with adjacent finish surface.
 - 01 Make exposed joints butt tight, flush, and hairline.
 - 02 Ease exposed edges to small uniform radius.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine masonry areas and structural supports to receive adjustable concealed lintel system.
- B. Verify dimensions, tolerances, and method of attachment with other work are properly fabricated and installed to properly interface with the concealed lintel system.
 - 01 Verify that imbeds, if required in adjacent masonry or other materials are installed to properly interface with the concealed lintel system.
- C. Notify Architect of conditions that would adversely affect installation.
- D. Do not begin installation until unacceptable conditions are corrected.
- E. Temporary Formwork:
 - 01 Provide formwork for placement in masonry to maintain true alignment until completion of permanent attachment.
 - 02 Provide temporary formwork as required to properly support masonry during installation of masonry arched lintels.

- 03 Temporary formwork shall be level, true to line and radius shall conform to finished radii shown on the Drawings.
- 04 Temporary formwork to directly contact / support masonry shall be new and free of defects.
- 05 Provide necessary support to maintain the masonry lintel in correct shape / positioning during mortar curing of the masonry lintel.

3.2 INSTALLATION

- A. Unless otherwise directed by the concealed masonry lintel system manufacturer, the lintel system shall be installed by the masonry subcontractor.
- B. Install all concealed lintel systems in accordance with manufacturer's instructions and shop drawings at locations indicated on the Drawings.
- C. Install items plumb and level, true to required radius, accurately fitted, free from distortion or defects.
- D. Adjust components to suit site conditions and as required to provide a completed masonry lintel installation in accordance with the Drawings.
- E. Obtain approval from Architect and manufacturer's representative before site cutting or making adjustments not scheduled.
- F. Perform field welding in accordance with AWS D1.1/D1.1M where necessary using certified welders.
- G. Mortar Beds:
 - 01 Place mortar in a manner which will result in the development of adequate bond between the masonry and the reinforcement and lintel system components.
 - 02 Lay units with full mortar coverage on horizontal and vertical joints in all courses.
 - 03 On masonry voids / holes to receive lintel system stitching rod reinforcing, completely fill the void / hole.
- H. Upon final set of the masonry mortar within the lintel system, carefully remove all temporary formwork.
- I. Thorough clean bottom of arched masonry lintels, removing all excess mortar.
- J. Rake temporarily concealed mortar joints to a smooth, concave shape to match mortar joints of surrounding masonry.

3.3 ALLOWABLE TOLERANCES

- A. Maximum tolerance for masonry directly interfacing with the concealed lintel system shall be as follows
 - 01 Maximum Variation from Plumb: 1/16"
 - 02 Maximum Variation from Level: 1/4"
 - 03 Maximum Variation from Designed Radius: 1/4" in a 24" section

3.4 PROTECTION

- A. Cover over all unfinished work at night against the elements with plastic sheet, building paper, heavy canvas or other material approved by Architect to prevent water from entering masonry cavities.
- B. Upon completion of masonry lintel work, use all means necessary to protect the masonry lintel installation from damage.
 - 01 If damaged, immediately make all repairs and / or replacements necessary to restore final conditions.
 - 02 Prior to any remedial work, obtain approval from the Architect and lintel system manufacturer for proposed remedial work.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all concrete masonry unit (CMU) masonry work where indicated on the Drawings and as required for a complete installation.
 - 02 Provide all face brick masonry work where indicated on the Drawings and as required for a complete installation.
 - 03 Provide all masonry reinforcing and ties as specified here-in; and required for a complete installation.
 - 04 Provide water repellant application to exterior veneer masonry.

1.2 SUBMITTALS

- C. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- D. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- E. Samples:
 - 01 Each type of face brick proposed to be furnished in quantities sufficient to show range of color where applicable.
 - 02 Samples of brick ties proposed to be furnished.
 - 03 Samples of full range of actual mortar color selections. Paper or digital samples are not acceptable.
 - 04 Sample of mortar deflector proposed to be furnished.
- F. Sample panel: Sample panel shall be 8' long min. x 6' high panel showing selected face brick color range and texture, bonding, mortar color, joint shape, and quality workmanship.
 - 01 Panel shall be "L" shaped (4' min. x 6') with metal stud / drywall back-up wall on one side and CMU back-up on one side. Coordinate as required with other trades. Include window frame mock-up in each panel.
 - 02 Include a brick expansion joint. Sample panel shall remain at the jobsite until all masonry is completed.
 - 03 Once accepted by the Architect, the sample panel shall be the standard by which installed CMU and face brick masonry shall be judged.
 - 04 Sample wall shall remain in place until all masonry work is complete.

- G. Operations and Maintenance Manuals:
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to Section 01 78 23 – Operations and Maintenance Manuals.
 - 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).
- H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. American Society for Testing and Materials:
 - 01 ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 02 ASTM C43 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 03 ASTM C62 – Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)
 - 04 ASTM C67 – Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
 - 05 ASTM C90 – Standard Specification for Loadbearing Concrete Masonry Units
 - 06 ASTM C216 – Standard Specifications for Facing Brick.
 - 07 ASTM C476 – Standard Specifications for Grout for Masonry.
 - 08 ASTM C652 – Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
 - 09 ASTM C744 – Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
 - 10 ASTM C140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - 11 ASTM D5095 – Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatment
 - 12 ASTM D6490 – Standard Test Method for Water Vapor Transmission of Non-Film Forming Treatments Used on Cementitious Panels
 - 13 ASTM D6532 – Standard Test Method for Evaluation of the Effect of Clear Water Repellent Treatments on Water Absorption of Hydraulic Cement Mortar Specimens
- B. Brick Industry Association (BIA).
- C. National Concrete Masonry Association (NCMA).
- D. National Fire Protection Association (NFPA) 285 – Standard Fire Test Methods for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Materials.

1.4 TESTS AND INSPECTIONS

- A. Architect may require tests and inspections as necessary to verify quality and strength of brick materials, mortar, grout, and workmanship.
 - 01 Material tests shall be made on actual materials as they are being installed on the project.
 - 02 Contractor shall coordinate and cooperate with testing lab as required for tests to be conducted.

- B. Laboratory tests of materials, mortar, grout and prisms shall be made per ASTM standard procedures.
- C. Contractor shall coordinate with testing lab as required to provide the necessary materials and samples.
- D. Owner will select Testing Laboratory and Owner will pay for all work required by Testing Laboratory.

1.5 DELIVERY, STORAGE AND PROTECTION

- A. Store all materials above the ground to prevent contamination by dirt, rust or other materials which may cause staining or other blemishes and defects.
- B. Store concrete and clay masonry units under cover and keep dry until used for installation.
- C. Store in manufacturer's original containers until opened for installation.
- D. Cementitious materials or admixtures in opened / broken containers or in packaging showing water marks or evidence of other damage shall be removed from the site and not used for installation.
- E. Bulk sand used for mixing mortar shall be placed on a waterproof membrane sufficient to prevent intrusion of ground water into the sand; and similarly, shall be covered as required to prevent intrusion of water / rain.

1.6 SITE CONDITIONS

- A. Cold Weather Protection: No masonry shall be laid when the temperature of the outside air is below 40°F, unless protection measures are employed and pre-approved by the Architect.
- B. Protection measures for cold weather erection include maintaining space and masonry unit temperatures of at least 40°F for 48 hours, prior to and after erection.

1.7 WARRANTY

- A. Warrant the masonry work specified herein for two (2) years after Substantial Completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to the following:
 - 01 Noticeable deterioration of masonry unit or mortar finish.
 - 02 Chalking or dusting excessively.
 - 03 Changing sheen in irregular fashion.
 - 04 Efflorescence.
- C. Warrant the masonry water repellant work specified herein for five (5) years after Substantial Completion against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers - Concrete Masonry Units – CMU: Design is based on products manufactured by Best Block Company.
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. Boral Concrete Products
 - b. Eagle-Cordell
 - c. Featherlite
 - d. IPC
 - e. Revels Block & Brick Co.
- B. Acceptable Manufacturers – Split-Face Masonry Units: design is based on products manufactured by Best Block Company.
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. Acme
 - b. Best Block
 - c. Boral Concrete Products
 - d. Cemex USA
 - e. Oldcastle / Trenwyth
 - f. Texas Building Products
- C. Acceptable Manufacturers - Face Brick: design is based on to match existing.
- D. Masonry Reinforcement, Anchors and Ties: design is based on products manufactured by Hohmann & Barnard (HB).
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. Heckmann Building Products (basis of design).
 - b. Dayton Superior / Dur-O-Wal
 - c. Wire-Bond
- E. Mortar Dropping Deflector: design is based on products manufactured by Mortar Net.
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. Heckman
 - b. Hohmann & Barnard (HB)
 - c. Polyguard Products
- F. Weep Hole Inserts: design is based on products manufactured by Hohmann & Barnard (HB).
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. Advanced Building Products
 - b. Heckman Building Products
 - c. Wire Bond

- G. Masonry Cleaning Products: design is based on products manufactured by Prosoco.
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. CBR Products
 - b. Diedrich Technologies
 - c. Dumond Chemicals
- H. Masonry Water Repellants: design is based on products manufactured by Prosoco.
 - 01 Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements.
 - a. Tnemec.
 - b. United Golsonite Laboratories (UGL).

2.2 MASONRY MATERIALS

- A. Masonry Veneer - Face Brick:
 - 01 Size: Modular Size (2-1/4" x 7-5/8" x 3-5/8")
 - 02 Brick:
 - a. To Match Existing on Building
 - 03 All face brick shall comply with ASTM C216, Grade SW, type FBX.
 - 04 Provide solids as required to ensure against exposed cores or unfinished faces or ends.
 - 05 Provide special shapes as indicated on the Drawings.
- B. Concrete Masonry Units:
 - 01 Face Dimensions: 8" x 16", modular depths (4", 6", 8", 12") as indicated on Drawings.
 - 02 Color shall be standard gray.
 - 03 Comply with ASTM C90.
 - a. Grade: N, highest standard
 - b. Type: I, Moisture -controlled unit
 - c. Aggregate: Lightweight
 - 04 When tested as a component of a masonry prism, CMU shall have a minimum compressive strength of 1,900 PSI, or higher if indicated on the Structural Drawings.
 - 05 Provide class D-2 units at 2-hour rated walls; class D-3 at 3-hour rated walls.
 - 06 Curing: Rotary kiln process.
 - 07 Provide bullnose units at all outside corners; except at walls to receive ceramic tile finish. Coordinate as required.
 - 08 Complete with bond beam, control joints, jambs, lintels, sills and fillers to match and compliment standard CMU.

2.3 MORTAR MATERIALS

- A. Type "S" Mortar:
 - 01 Use at all CMU masonry work.
 - 02 Hydrated Lime: ASTM C207, TYPE "S"
 - 03 Portland Cement: ASTM C150, Type 1
 - 04 Water: Clean and potable
 - 05 Sand: ASTM C144
 - 06 Type "S" Mix Design: (Proportions by volume):

- a. Type: ASTM C270, Type "S"
 - b. Proportions: 2 parts cement, 1-part hydrated lime and 9 parts sand to provide a compressive strength of 1800 PSI in 28 days.
 - c. Mixing: Thoroughly machine-mix for at least 5 minutes after all material is in mixer.
- 07 Do not use calcium chloride.
- B. Type "N" Mortar:
 - 01 Use at all masonry veneer work.
 - 02 Hydrated Lime: ASTM C207, TYPE "N" or "S"
 - 03 Portland Cement: ASTM C150, Type 1
 - 04 Water: Clean and potable
 - 05 Sand: ASTM C144
 - 06 Type "N" Mix Design: (Proportions by volume)
 - a. Type: ASTM C270, Type "N"
 - b. Proportions: 1-part cement, 1-part hydrated lime and 6 parts sand to provide a compressive strength of minimum 750 PSI in 28 days.
 - c. Mixing: Thoroughly machine-mix for at least 5 minutes after all material is in mixer.
 - 07 Do not use calcium chloride.
- C. Mortar Colors:
 - 01 Provide standard gray mortar for all concealed masonry and masonry to receive a painted finish.
 - 02 Mortar at exposed / unfinished masonry shall be as selected by the Architect from manufacturer's full range of mortar colors – minimum of 12.
- D. Site Mixed Mortar:
 - 01 All site mixed masonry components shall be added to mixer using quantifiable mixing containers (i.e. cubic-foot boxes, known quantity liquid devices and similar containers).
 - 02 Adding components by shovel is not permitted.
- E. Mortar Deflector:
 - 01 3-dimensional, polypropylene or polyethylene mesh product designed to be a continuous application at the base of a brick ledge.
 - 02 Deflector shall be dual level to eliminate continuous build-up of mortar on the upper edge.
 - 03 Deflector shall fill the width of the brick cavity up to minus (-) 1/2".
 - 04 Deflector shall be non-corrosive.
 - 05 Provide continuous at base of all brick veneer, brick ledges, lintels and metal through-wall flashing conditions.
- F. Weep Hole Inserts:
 - 01 Design is based on HB QV-Quadro Vent Weep Hole Insert.
 - 02 Polypropylene honeycomb unit to be installed at brick veneer weep holes.
 - 03 Conforming to ASTM D2240, D790B, D638 and D1238B.
 - 04 Size to fit the head dimension of the brick unit being used.
 - 05 Unit to be installed flush with the exterior face of the veneer.
 - 06 Color to be selected from manufacturer's standard finishes.
 - 07 Provide at all weep holes.

2.4 MASONRY REINFORCING MATERIALS

- A. General:
 - 01 All masonry reinforcing shall be hot-dipped galvanized after fabrication in accordance with ASTM A153.
 - 02 All truss type reinforcing shall be fabricated using be 9-gauge rod materials unless noted / specified otherwise.
 - 03 All truss type reinforcing shall be furnished with prefabricated corners and tees to be used where applicable.
 - 04 All truss type reinforcing shall be provided in nominal widths, 2" less than masonry it is being installed in.
- B. Truss Type Reinforcing – Single Wythe Masonry:
 - 01 Design is based on HB no. 120 Lox-All Truss-Mesh or Ladder-Mesh Joint Reinforcing.
 - 02 Provide in continuous lengths wherever possible.
 - 03 Spacing: nominal 16" O.C. vertically
- C. Truss Type Reinforcing – Multiple Wythe CMU Composite Walls:
 - 01 Design is based on HB no. 140 Lox-All Truss-Mesh or Ladder-Mesh Joint Reinforcing.
 - 02 Provide in continuous lengths wherever possible.
 - 03 Spacing: nominal 16" O.C. vertically
- D. Truss Type Reinforcing – CMU Back-Up Walls With Brick Veneer:
 - 01 Design is based on HB no. 170 Lox-All Truss Style Adjustable Joint Reinforcement.
 - 02 Provide with 3/16" Eyes and Pintles.
 - 03 Provide pintle length / size as required to extend to 3/4" to 1" from outside face of masonry veneer.
 - 04 Pintles shall allow for a minimum of 1-1/4" vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
 - 05 Provide in continuous lengths in horizontal joints.
 - 06 Spacing: nominal 16" O.C. vertically; eyes and pintles at 16" O.C. horizontally.
- E. Masonry Ties – Veneer at Metal Stud Back-Up Walls – With Rigid Insulation:
 - 01 Design is based on HB no. HB-213 series 2-Piece Adjustable Anchors.
 - 02 L-shaped plate bracket; 12-gauge material.
 - 03 Provide with 3/16" pintles.
 - 04 Provide pintle length / size as required to extend to 3/4" to 1" from outside face of masonry veneer.
 - 05 Pintles shall allow for a minimum of 1-1/4" vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
 - 06 Spacing: nominal 16" O.C. vertically; and 16" O.C. horizontally.
- F. Masonry Ties – Veneer at Metal Stud Back-Up Walls – Without Rigid Insulation:
 - 01 Design is based on HB no. DW-10HS series 2-Piece Veneer Anchors.
 - 02 Slotted, 5-1/2" long plate bracket; 12-gauge material.
 - 03 Provide with 3/16" triangular wire tie.
 - 04 Provide wire tie length / size as required to extend to 3/4" to 1" from outside face of masonry veneer.

- 05 Pintles shall allow for a minimum of 1-1/4" vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
- 06 Spacing: nominal 16" O.C. vertically; and 16" O.C. horizontally.
- G. Masonry Ties – Steel:
 - 01 Design is based on HB series 359 2-piece anchors welded to steel structure / components.
 - 02 Provide with 3/16" triangular wire tie.
 - 03 Provide wire tie length / size as required to extend to 3/4" to 1" from outside face of masonry veneer.
 - 04 Pintles shall allow for a minimum of 1-1/4" vertical adjustment. Provide in greater adjustment configuration where required due to masonry coursing.
 - 05 Spacing: nominal 16" O.C. vertically; and 16" O.C. horizontally.
- H. Control Joint Anchors:
 - 01 Masonry Veneer and CMU Control Joints: design is based on HB Corrugated Control Joint Anchor.
 - 02 Material: Type 304 stainless steel
 - 03 Size: 6-1/4" x 1" x 22 gauge
 - 04 Install at all horizontally reinforced joints of masonry veneer and CMU.
- I. Cast Stone Anchors:
 - 01 Design is based on HB No. 309 and No. 309-H or similar anchor as recommended by the cast stone manufacturer.
 - 02 Coordinate as required for proper type and quantities.
- J. All fasteners used to connect masonry ties and similar products through the weather barrier shall be cadmium plated and provided with neoprene washers.

2.5 CMU MASONRY REINFORCING

- A. All reinforced CMU masonry reinforced with grade 60 rebar and cells filled with grout.
 - 01 Grout shall meet or exceed requirements of ASTM C476.
 - 02 Grout shall be a blend of cement, sand, aggregate and water required to create a flowable mixture.
 - 03 Grout compressive strength shall be a minimum of 2,000 PSI at 28 days.
 - 04 Use at all vertical reinforced cells, hollow metal doors frames, bond beams, lintels and other locations indicated on the Drawings or required for a complete masonry installation.
 - 05 Refer to Structural Drawings for additional information and requirements.
- B. Coordinate as required for installation of rebar dowels set in concrete foundation to connect to all CMU vertical reinforced cells.
 - 01 Unless noted otherwise, rebar dowels for 8" or larger CMU shall be #5 rebar, 30" in length, embedded nominally 12" into concrete foundation.
 - 02 Unless noted otherwise, rebar dowels for 6" CMU shall be #4 rebar, 30" in length, embedded nominally 12" into concrete foundation.
 - 03 Reinforcing shall be continuous from slab to top of wall. Splice in accordance with Section 03 30 00 – Cast-in-Place Concrete.
 - 04 Vertical reinforcing shall tie to reinforcing at bond beams and lintels.

- C. Unless noted more stringent on the Structural Drawings, provide reinforcing in vertical CMU cells at the following locations:
 - 01 General Field / Run of Walls: 48" O.C. maximum.
 - 02 End of Walls: at end cell.
 - 03 Wall Corners: at corner cell and adjacent cell each side.
 - 04 Wall Intersections: two cells at intersection (one each wall).
 - 05 Openings: at one cell each side of opening.
 - 06 Expansion / Control Joints: at one cell each side of joint.
 - 07 Refer to Structural Drawings for additional information.
- D. CMU Lintels:
 - 01 At 6" CMU Lintels: (1) #4 bar and fill with pea gravel concrete or grout.
 - 02 At 8" CMU Lintels: (1) # 5 bar at 8" / (2) #5 bars at 16" and fill with pea gravel concrete or grout.
 - 03 At 12" CMU Lintels: (2) # 5 bars and fill with pea gravel concrete or grout.
 - 04 Lintels shall extend a minimum of 8" beyond openings and tied to vertical cell reinforcing at jambs.
- E. CMU Bond Beams:
 - 01 Provide continuous CMU bond beams at top of, or last full accessible course of all CMU walls.
 - 02 On walls heights 14' or taller, provide a bond beam at the mid-point of the wall.
 - 03 Bond beam reinforcing shall be as described for CMU lintels above.
 - 04 Bond beams shall be tied to vertical cell reinforcing.
 - 05 Refer to Structural Drawings for mechanical linkage between CMU walls and steel structure.

2.6 MASONRY CLEANING AND PROTECTION

- A. Masonry Cleaning Products:
 - 01 Cleaning materials for the purpose of removing excess mortar, job dirt and normal job stains from light colored brick and tile units which are not subject to metallic stains shall be Sure Klean® 600 Detergent manufactured by Prosoco; or approved equal.
 - a. Specific Gravity: 1.117
 - b. pH: 0.3 (1:6 dilution)
 - c. Flash Point: None
 - d. Freeze Point: -30°F (-34.4°C)
 - e. Weight/Gal.: 9.3 lbs
 - 02 Cleaning materials for purposes of removing excess mortar, job dirt and normal job stains from brick and tile units which are subject to metallic oxidation stains shall be Sure Klean® Vana Trol® manufactured by Prosoco Co.; or approved equal.
 - a. Specific Gravity: 1.117
 - b. pH: 0.3 (1:6 dilution)
 - c. Flash Point: None
 - d. Freeze Point: -30°F (-34.4°C)
 - e. Weight/Gal.: 9.3 lbs
 - 03 Cleaning material for removal of excess mortar and job dirt from brick, concrete, tile and stone surfaces shall be Enviro Klean® Mortar & Grout Remover manufactured by Prosoco Co.; or approved equal.
 - a. Flash Point: None
 - b. Specific Gravity: 1.00
 - c. pH: 1.6 (Dilute 1 pound of powder to 1 gallon of water.)

- 04 Consult brick supplier/manufacturer to confirm proper selection of cleaning detergent to minimize reaction from metallic or other mineral deposits.
- B. Masonry Water Repellant Sealant:
 - 01 Design is based on Prosoco Sure Klean® Weather Seal Siloxane PD.
 - a. Solids: 4.0% ASTM D5095
 - b. Specific gravity: 0.996
 - c. Flash point: > 212 degrees f per ASTM D3278
 - d. VOC: <30 grams/liter
 - 02 Water Absorption Reduction Rates:
 - a. Mortar: 98% minimum per ASTM D6532
 - b. Brick: 89% minimum per ASTM C67
 - c. CMU: 95% minimum ASTM C140

PART 3 - EXECUTION

3.1 PREPARATION OF MATERIALS

- A. Concrete Masonry Units
 - 01 Lay out CMU to coordinate with reinforcing dowels in slab, centered in CMU vertical cells.
 - 02 Where cutting is required, masonry shall be cut with a sharp masonry saw.
 - 03 Lay out split face masonry to yield a generally uniform appearance, without extreme variations from unit to unit.
 - 04 Lay out CMU to eliminate installation of small cuts as much as practical.
- B. Brickwork:
 - 01 Dampen brick before laying in a manner consistent with the nature of the brick, the mortar, and the weather conditions.
 - 02 Lay out masonry to eliminate installation of small cuts as much as practical.
- C. Mortar and Grout:
 - 01 Use suitable containers for material measurement (i.e. metal or wood cubic foot box, graduated bucket, etc.). Measuring sand with a shovel is not acceptable.
 - 02 Mix a minimum of 5 minutes.
 - 03 Consistency will completely fill all spaces intended to receive grout.
 - 04 Use within 2-1/2 hours of initial mixing.
 - 05 Mortar or grout shall not be used if curing has progressed to yield a stiff consistency or flash set.
- D. Reinforcement:
 - 01 Reinforcement shall be free from loose rust and other coatings that would reduce the bond.
 - 02 Cut accurately to length and bend by such methods as will prevent injury to the material.
- E. Straighten out kinks or bends.

3.2 ALLOWABLE TOLERANCES

- A. Maximum Variation from Plumb:
 - 01 In lines and surfaces of columns, walls and at rises:
 - a. 1/4" in 10' (1:480)
 - b. 3/8" in 20' (maximum)
 - c. 1/2" in 40' (1:960)
 - 02 For external corners, expansion joints and other conspicuous lines:
 - a. 1/4" in 20' (maximum)
 - b. 1/2" in 40' (1:960)
- B. Maximum variation from level:
 - 01 1/4" in any 20' (1:480)
 - 02 1/2" in any 40' (1:960)

3.3 INSTALLATION

- A. Contractor shall use all means necessary to ensure all masonry work is adequately braced at all times during erection.
- B. General:
 - 01 Do not use chipped brick or chipped block where exposed to view.
 - 02 Use masonry saws to cut and fit exposed units.
 - 03 Lay units plumb, true to line, and with level courses accurately spaced within allowable tolerances.
 - 04 Do not furrow bed joints.
 - 05 Stop off horizontal run by racking back in each course; toothing is not permitted.
 - 06 Adjust units to final position while mortar is soft and plastic.
 - 07 If units are displaced after mortar has stiffened, remove, clean joints and units and re-lay with fresh mortar.
 - 08 When joining fresh masonry to set or partially set masonry:
 - a. Remove loose masonry units and mortar.
 - b. Clean and lightly wet exposed surface of set masonry prior to laying fresh mortar.
- C. Metal Door Frames Anchored to Masonry: Fill jamb frames solid with mortar as Work progresses. Install masonry anchors, securing to frame and adjacent vertical reinforcement. Fill head frame solid with mortar prior to installing lintel units.
- D. Lintels and Bond Beams: Provide reinforced unit type, except where steel lintels are shown. Use reinforcing bars as shown on the Drawings. Completely fill lintels and bond beams with pea-gravel concrete. Provide 8-inch bearing at end of lintels.
- E. Partitions Tops: Allow space at top of horizontal spanning walls for compressible joint back-up and sealant as specified in Section 07 92 00 – Joint Sealants. Anchor top of walls to deck or structure.
- F. Brick Ledge and Through Wall Flashing:
 - 01 Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing material.
 - 02 Place through-wall flashing on bed of mortar and cover with mortar.

- G. Mortar Beds:
- 01 Place mortar in a manner which will result in the development of adequate bond between the masonry and the reinforcement.
 - 02 Lay units with full mortar coverage on horizontal and vertical / head joints in all courses.
 - 03 Provide sufficient mortar on ends of masonry unit to fill head joints.
 - 04 Rock closures into place with head joints thrown against two adjacent masonry units in place.
 - 05 Do not pound corners or jambs to fit stretcher units after setting in place.
 - 06 Where adjustment to corners or jambs must be made after mortar has started to set, remove mortar and replace with fresh mortar.
- H. Weepholes:
- 01 Provide weepholes in head joints in course immediately above all thru-wall and self-adhered flashing at all exterior brick walls.
 - 02 Leave head joint free and clean of mortar.
 - 03 Spacing:
 - a. Modular Brick and Stone: 24-inch O.C. maximum.
 - b. King Size Brick: 30-inch O.C. maximum.
 - c. CMU: 32-inch O.C. maximum.
 - 04 Keep weepholes and area at flashing free of mortar droppings.
 - 05 Install weep hole inserts at all weep hole head joints.
- I. Cavity:
- 01 The level to which brick cavities shall be free of excess mortar shall be as established and approved on the masonry mock-up wall. Keep masonry cavity clean and free of excess mortar.
 - 02 Carefully lay first course at brick ledge and lintels, making sure that cavity is clean of all excess mortar which may impede the flow of moisture through weep holes.
 - 03 As work progresses, trowel and remove all protruding fins in cavity flat on inner surface of the wythe brick cavity.
 - 04 Take all necessary precaution to not allow excess mortar to drop within cavity from the inner surface of the wythe.
 - a. Use wood strips with attached wire pulls or other suitable means to collect all loose mortar below the course being laid.
 - b. Remove all mortar and clean the device at regular intervals while mortar is still elastic and able to be removed without disturbing masonry already laid above it.
 - 05 Cavities shall be inspected and excess mortar within the masonry cavity shall be grounds for removal and replacement of masonry if no other practical means is available to remove excess mortar; all at contractor's expense.
- J. Mortar Joints and Patterns:
- 01 Refer to Drawings for accent coursing.
 - 02 Lay brick in running bond pattern.
 - 03 Lay standard CMU in one-half running bond pattern.
 - 04 Provide flush joints where concealed from view and where dampproofing is scheduled.
 - 05 Provide standard concave tooled joint where masonry is exposed to view for brick and CMU, typically. Provide recessed accent joints in brick where indicated on elevations.
 - 06 All mortar joints to be of consistent size.
 - 07 Refer to the Drawings for paver patterns.

- K. Reinforcement/Tie Systems:
- 01 Completely embedded in mortar or grout.
 - 02 All reinforcement consisting of bars or wire 1/4 inch or less in diameter, embedded in the horizontal mortar joints, shall have no less than 5/8 inch mortar coverage from the exposed face.
 - 03 Truss reinforcing within each wythe shall be at 16-inch O.C. vertically for exterior wythes and back-up wythes, whether detailed or not.
 - 04 Veneer anchors at sheathing covered metal stud exterior walls shall be attached on outside face of sheathing using cadmium plated sheet metal screws. Spacing shall be 16-inch O.C. horizontally and 16-inch O.C. vertically.
 - 05 Veneer anchors at Interior brick walls with metal stud back up shall be the same as Paragraph "D" above, except anchors shall be attached directly to metal stud with cadmium plated sheet metal screws.
 - 06 At intersection of all perpendicular masonry walls provide two vertical rows of corrugated wall ties at 16-inch O.C. vertically (7/8" wide x 16-gauge galvanized steel).
 - 07 In cavity walls with CMU back up, embed truss type horizontal reinforcement with integral wall ties every 16 inches O.C. vertically.
 - 08 Splices in reinforcement: Splices may be made only at such points and in such manner that the structural strength of the member will not be reduced. Lapped splices shall be 8 inches. Welded or mechanical connection shall develop the strength of the reinforcement.
 - 09 Corrugated strap ties shall not be used as veneer anchors.
 - 10 Place joint reinforcement in the first two bed joints above and the first two bed joints below masonry openings.
 - 11 Provide masonry ties at floor and roof decks as indicated.
- L. Corners: Connect corners with No. 9 galvanized wire or corrugated tie using one tie for each 4 inches of nominal wall thickness.
- M. Masonry Joints: Expansion Joints/Control Joints:
- 01 The mortar joint which stops at the expansion joint cavity shall be struck flush with the masonry unit, producing a continuous flat surface for the sealant to adhere to.
 - 02 Place masonry control joints and expansion joints as indicated on the Drawings. If not indicated, place joints at 20'-0" O.C. maximum and at each side of openings. Coordinate with Architect for exact locations.
 - 03 Provide CMU control joints directly over concrete slab control joints. Whenever possible, lay out CMU so that control joint will coincide with CMU module (20' maximum spacing between control joints).
 - 04 Provide masonry joints at structural columns to isolate movement from continuing or intersecting walls and columns.
- N. Sealant Joints:
- 01 Allow for sealant joints around outside perimeters of exterior doors, window frames and other wall openings.
 - 02 Uniform depth: 3/4 inch
 - 03 Uniform width: not less than 1/4 inch and not more than 1/2 inch.
 - 04 Provide sample for Architect's approval.
 - 05 Refer to drawings for locations and details of accent joints.

- O. Mortar Deflector:
 - 01 Provide in continuous lengths at base of all masonry installations including brick ledges, lintels and similar conditions where weep holes are present.
 - 02 Install in accordance with manufacturer's standards and requirements.

3.4 CLEANING

- A. At completion of the Work, fill and retool holes in joints of exposed masonry surfaces with mortar.
- B. After pointing has set and hardened, clean exposed masonry surfaces with cleaning agent recommended for each type of masonry used.
- C. Leave masonry clean, free of mortar daubs and with tight mortar joint throughout.
- D. After brickwork is set, protect all edges and corners from damage.
- E. The cleaning shall be in accordance with manufacturers printed instructions for type of cleaning agent used.
 - 01 Use a stiff brush where possible for all cleaning.
 - 02 If a pressure washer is required, use pressure at 300 PSI or less as required to prevent damage of any kind to masonry (i.e. chipping units or mortar, removing brick texture, etc.).
 - 03 Keep tip a minimum of 24" from face of wall being cleaned.

3.5 MASONRY WATER REPELLANT SEALER

- A. Upon completion of cleaning all masonry surfaces, apply the masonry water repellant sealant material to all masonry surfaces using a low pressure.
- B. Application: Before applying, read "Protect" and "Precautionary Measures" sections in the Manufacturer's Product Data Sheet for Weather Seal Siloxane PD. Refer to the Product Data Sheet for additional information about application of Weather Seal Siloxane PD. Do not dilute or alter.
- C. Vertical Application Instructions:
 - 01 For best results, apply protective treatment "wet-on-wet" to a visibly dry and absorbent surface.
 - 02 Alternate Application Methods:
 - a. Spray: Saturate from the bottom up, creating a 4" to 8" (15 to 20 cm) rundown below the spray contact point. Let the first application penetrate for 5-10 minutes. Re-saturate. Less will be needed for the second application.
 - b. Brush or roller: Saturate uniformly. Let protective treatment penetrate for 5 to 10 minutes. Brush out heavy runs and drips that don't penetrate.
 - c. Dense Surface Application Instructions: Apply in a single, saturating application with no run down. Back roll all runs and drips to ensure uniform appearance. DO NOT OVER APPLY. One application is normally enough. Always test.
 - 03 Horizontal Application Instructions:
 - a. Saturate in a single application. Use enough to keep the surface wet for 2 to 3 minutes before penetration.

- b. Brush out puddles until they soak in. Treated surfaces dry to touch in 1 hour.
- c. Protect surfaces from rainfall for 6 hours following treatment. Many surfaces need several days to develop full water repellency.

3.6 PROTECTION

- A. Cover over all unfinished work at night against the elements with plastic sheet, building paper, heavy canvas or other material approved by Architect to prevent water from entering masonry cavities.
- B. Upon completion of masonry work, use all means necessary to protect the masonry installation from damage. If damaged, immediately make all repairs and / or replacements.

END OF SECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION *Specifier: Coordinate this paragraph with your project requirements.*

IF project is CSP – use this A.

- A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

IF project is CM@R – replace A with the following:

Refer to Section 01 25 00 – Request for Substitution Procedures.

IF project is CSP – delete this B.

IF project is CM@R - Find out if proposal instructions are provided or NOT provided.)

- B. Refer to the CM@R Proposal Instructions. (Issued under separate cover.)

IF project is NOT in “Hurricane” zone – delete this C.

- C. This project is in the TWIA Zone: Inland I and building envelope components shall meet the requirements for certification / approval of Texas Department of Insurance. (TDI.)

Tailor to your project specific information.

- D. Scope of Work: The structural framing plans and details indicate general framing required. Other structural steel components and assemblies are indicated on other (non-S) sheets. In addition to work / materials indicated on the structural sheets, Work of this Section shall also include, but not be limited to the following:

- 01 Loose lintels.
- 02 Framed openings in floor and / or roofs for installation of equipment and other “through” work.
- 03 Suspension framing for structurally supported masonry lintels.
- 04 Flat plate / angle required for masonry supported directly on steel framing.
- 05 Sleeves for embedded work.
- 06 Other structural shapes / components described in other Division 5 Specification Sections.

Tailor to your project specific information.

- E. Related Work:

- 01 Section 05 12 13 – Architecturally Exposed Structural Steel Framing
- 02 Section 05 21 00 – Steel Joist Framing
- 03 Section 05 31 00 – Steel Decking
- 04 Section 05 41 00 – Structural Metal Stud Framing
- 05 Section 05 50 00 – Metal Fabrications
- 06 Section 05 51 00 – Metal Stairs
- 07 Section 05 51 33.23 – Alternating Tread Ladders
- 08 Section 05 52 13 – Pipe and Tube Railing
- 09 Section 05 52 16 – Decorative Handrail System
- 10 Section 05 71 13 – Fabricated Metal Spiral Stairs

Tailor to your project specific information.

- F. Contractor / fabricator shall verify all conditions and requirements for structural steel as required for a complete project as indicated on the Contract Documents.

01 All required work shall be included in the Base Proposal amount.

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 01 Certifications:
 - a. Material Certifications: Documentation certifying with grade compliance of specified structural steel components.
 - b. Domestic Source: Documentation certifying source / origin of structural steel components proposed to be furnished.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and location of structural steel members.
 - 02 Details and schedules for fabricating and assembly of structural steel. Include details of cuts, connections, camber, holes, and other pertinent data.
 - 03 Indicate welds by Standard AWS symbols and show size, length and type of each weld.
 - 04 Show profiles, sizes, spacing, and locations of shop fabricated components and assemblies.
 - 05 Show details of shop fabrications, connections and details.
 - 06 Show details of field erection fabrications, connections and details.
 - 07 Provide calculations demonstrating compliance with wind load and other requirements.
 - 08 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.
- D. Installation Instructions: Submit manufacturer's complete installation / erection instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

1.3 REFERENCES

- A. American Society for Testing and Materials:
 - 01 ASTM A36 – Structural Steel.
 - 02 ASTM A123 / A123M – Standard Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - 03 ASTM A153 / A153M - Standard Specifications for Zinc (Hot-Dip) on Iron and Hardware.
 - 04 ASTM A307, Carbon Steel Externally and Internally Threaded Standard fasteners.
 - 05 ASTM A385, Providing High-Quality Zinc Coating (Hot Dip).
 - 06 ASTM A325, High Strength Bolts for Structural Steel.
 - 07 ASTM A500, Cold formed welded and seamless carbon sheet structural tubing in rounds and shapes.
 - 08 ASTM A992, Steel for Structural Shapes for use in Building Framing.
- B. Federal Specification: Fed. Spec. TT-P-664 and MIL-P-53030.

- 1 C. American Institute for Steel Construction:
2 01 Specifications for the Design, Fabrication and Erection of Structural Steel for
3 Buildings - Latest Edition.
4 02 Code of Standard Practice - Latest Edition.
5
6 D. American Welding Society: American Welding Society Structural Welding Code
7 D11.1-77.
8
9 E. American Iron and Steel Institute Specification for Design Fabricated and Erection of
10 Cold Formed Steel.
11

12 **1.4 QUALITY ASSURANCE**

- 13
14 A. Testing Laboratory Services:
15 01 Test results shall meet or exceed established standards.
16 02 Testing Lab shall inspect erected steel prior to cover-up to verify conformance
17 with the specified requirements.
18 03 Work to be inspected shall include, but not necessarily limited to the
19 following:
20 a. Welds at bar joists prior to installation of decking.
21 b. Welds / connection of decking to structural components.
22 c. Moment connections.
23 d. Random torque testing of bolted connections.
24
25 B. Building / Construction Components: Meet or exceed established standards.
26

27 **PART 2 - PRODUCTS**

28 **2.1 MANUFACTURERS**

- 29
30
31 A. Structural Steel: All structural steel shall be produced domestically in the United States.
32 01 Deviations from this requirement, if any, shall be clearly stated in the
33 submittals; including origin of non-US produced steel.
34
35 B. Non-Shrink Grout: Design of non-shrink grout is based on products manufactured by
36 Master Builders Solutions / BASF.
37
38 C. Non-Shrink Grout Acceptable Manufacturers: The following manufacturers are
39 acceptable to provide products of this Section provided proposed materials meet or
40 exceed all specified requirements:
41 01 Gifford Hill
42 02 Hallemite
43 03 Sika Chemicals
44

45 **2.2 MATERIALS**

- 46
47 A. Structural Steel:
48 01 Comply with ASTM A992.
49 02 Plates, angles, and channels shall comply to ASTM A36.
50 03 Steel Tubes shall comply with ASTM A500 - Grade B (Fy= 46 KSI).
51
52 B. Welding: Shall conform to the American Welding Society (AWS) standards and
53 recommendations.
54
55 C. Bolts:

- 01 Comply with ASTM A307, standard bolt and ASTM A325N automatic shearing high strength bolts.
- 02 Size: 3/4" or as shown on Drawings.
- D. Shop Painting:
- 01 Comply with Fed. Spec. TT-P-636.
- 02 Preparation: Steel shall be clean, dry, and free of rust.
- 03 Shop-coat all items except galvanized members and members to receive sprayed-on fireproofing. Coordinate as required.
- E. Galvanized Metal:
- 01 Comply with ASTM A123 / ASTM 123M.
- 02 General: Galvanize all steel sections which are fully or partially exposed to weather, regardless if they are scheduled to receive a finish coat of paint or not.
- 03 Do not apply silicone protective coating to galvanized steel.
- F. Design of Non-Shrink Grout is based on Master Builders Solutions / BASF MasterFlow 885 High-Precision Non-Shrink Grout.
- 01 Provide below all column base plates; and other locations where indicated on the Drawings.
- 02 Properties at 28 days:
- a. Compressive Strength: 9,000 PSI minimum
 - b. Volume Change: 0.08% (ASTM C-1107)
 - c. Flexural Strength: 1,150 PSI
 - d. Punching Shear Strength: 2,600 PSI
- G. Loose Lintels: Unless shown otherwise on the Drawings, provide steel angle lintels bearing 8" each side beyond all masonry openings in the following sizes:
- 01 0" to less than 5'-0" 3-1/2 x 3-1/2 x 5/16
- 02 5'-0" to less than 6'-0" 5 x 3-1/2 x 5/16 LLV
- 03 6'-0" to less than 8'-0" 6 x 3-1/2 x 5/16 LLV
- 04 8'-0" to 10'-0" 7 x 4 x 3/8 LLV
- 05 Lintels for openings wider than 10'-0" shall be structurally suspended as indicated on the Drawings.
- a. If not specifically shown, provide a 4 x 3-1/2 x 5/16" (LLV) lintel angle with 3 x 3 x 1/4" vertical and diagonal angle supports at 48" O.C. maximum suspended and anchored to structure above.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Conform to applicable requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" issued by the American Institute for Steel Construction.
- B. Fabricate structural members in continuous lengths, unless indicated otherwise on the Drawings.
- C. All shop fabricated assemblies shall be shop welded.
- 01 Provide minimum 1/4" continuous fillet welds unless indicated otherwise on the Drawings.
- 02 Coordinate shop fabricated assembly connections to be made in the field.
- D. Size column base plates as required to be concealed in finished Work. Coordinate with other trades as required.

- 1
2 E. Galvanizing:
3 01 All structural steel exposed directly to the outside environment shall be
4 galvanized.
5 02 Additionally, provide galvanized steel as indicated on the Drawings.
6 03 All steel to be galvanized shall be hot-dipped galvanized after fabrication is
7 complete.
8

9 **3.2 ERECTION**

- 10
11 A. Conform to applicable requirements of "Specifications for the Design, Fabrication and
12 Erection of Structural Steel for Buildings" issued by the American Institute for Steel
13 Construction.
14
15 B. Provide steel shims or double nut connection at column base plates as required to
16 achieve correct elevations.
17
18 C. All beam-to-column, beam-to-beam and similar field connections shall be bolted unless
19 indicated otherwise on the Drawings.
20
21 D. Provide temporary bracing and / or tension cables as required to plumb and level
22 structural steel framing.
23 01 Leave temporary measures in place until structural steel is loaded (i.e. upper
24 floors poured and cured, all joist bracing is installed, roof deck installed and
25 cured).
26 02 Upon removal, verify that all structural steel is plumb and level to elevations
27 indicated on the Drawings.
28
29 E. Miscellaneous Steel:
30 01 Miscellaneous steel includes, but is not limited to joist bracing, suspended
31 lintels and similar assemblies, floor and roof edge angles, and similar non-
32 primary steel components and assemblies.
33 02 All miscellaneous steel shall be welded in place unless otherwise indicated on
34 the Drawings.
35
36 F. Touch up field connections and other damaged areas in shop coat as erection proceeds.
37 Use same material as shop coat.
38
39 G. Grout solid under base plates to required elevations. Allow grout to cure prior to filling
40 column recesses with concrete.
41
42
43
44

END OF SECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

SECTION 05 41 00

STRUCTURAL METAL STUD FRAMING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION *Specifier: Coordinate this paragraph with your project requirements.*

IF project is CSP – use this A.

- A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.

IF project is CM@R – replace A with the following:

Refer to Section 01 25 00 – Request for Substitution Procedures.

IF project is CSP – delete this B.

IF project is CM@R - Find out if proposal instructions are provided or NOT provided.)

- B. Refer to the CM@R Proposal Instructions. (Issued under separate cover.)

IF project is NOT in “Hurricane” zone – delete this C.

- C. This project is in the TWIA Zone: Inland I and building envelope components shall meet the requirements for certification / approval of Texas Department of Insurance. (TDI.)

Tailor to your project specific information.

- D. Scope of Work:

01 Light gauge steel framing at all exterior walls, and exterior envelope.

02 Light gauge structural steel framing at interior locations as indicated on the Drawings.

03 All comments within this specification section shall be adhered to and included in the design by the Texas registered engineer.

Tailor to your project specific information.

- E. Related Work:

01 Section 05 12 00 – Structural Steel Framing

02 Section 06 10 00 – Rough Carpentry

03 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

- A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.

- B. Product Data: Manufacturer's specifications and other data for all products proposed to be furnished as needed to demonstrate compliance with specified requirements.

- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies based off provided contract documents.

01 Show profiles, sizes, spacing and locations of framing components.

02 Show details of shop fabrications, connections and details.

03 Show details of field fabrications, connections and details.

01 Drawings shall depict all conditions of the building envelope.

02 Include framing and connection details for all envelope wall conditions (i.e. field of walls, rough openings, and special conditions); complete with fastener size, quantity and installation patterns.

- 03 If proposed, clearly indicate proposed adjustments to member sizes as indicated on the Drawings; however, such adjustment shall not deviate to a less gauge or less stringent spacing than what is specified.
- 04 Provide calculations demonstrating compliance with wind load and other requirements.
- 05 Shop drawings shall be sealed and signed by a Texas registered engineer.
- 06 All comments within this specification section shall be adhered to and included in the design by the Texas registered engineer.
- D. Manufacturer's installation instructions for all components and assemblies based off provided contract documents.
- E. Sample Panel: Sample panel shall be 8' long x 6' high panel showing completed exterior light gauge steel framing assembly, complete with exterior sheathing, dampproofing and rigid insulation (where applicable).
- 01 Assembly shall include a framed opening.
- 02 Coordinate as required with other trades. Refer to Section 04 20 00 – Unit Masonry for additional information.

1.3 QUALITY ASSURANCE AND REFERENCES

- A. All materials proposed to be furnished shall comply with the following:
- 01 AISI: Specification for the Design of Cold-Formed Steel Structural Members. Latest edition and amendments.
- 02 ASTM C955: Standard specification for load bearing (transverse and axial) steel studs, runners (tracks), bracing and bridging for screw application of gypsum board metal plaster bases.
- 03 ASTM A653: Steel Sheet, Zinc Coated (galvanized) by the Hot-Dip Process, Structural Quality.
- 04 ASTM A924: Steel Sheet, Metallic Coated by the Hot-Dip Process, General Requirements.
- 05 ASTM A570: Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality.
- 06 ASTM A611: Steel, Cold-Rolled Sheet, Carbon, Structural.
- 07 MLSFA: Steel Framing Manual.
- 08 Welding Qualifications: Quality welding processes and welding operations in accordance with AWS "Standard Qualification Procedure".

Note: Confirm the following is accurate for your project.

- B. All exterior framing shall be designed to meet or exceed requirements of TWIA Inland II Zone, Exposure C; and additionally, a minimum wind load generated by 120 MPH, 3 second gusts.
- C. The Drawings depict general light gauge steel framing configurations and requirements; and is presumed adequate to permit compliance with the specified performance requirements.
- D. Specific design in compliance with this Specification is the responsibility of the light gauge metal framing provider; including, but not limited to:
- 01 Member sizes.
- 02 Material thicknesses.
- 03 Methods and detail of attachment.
- 04 Bracing / bridging.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1 A. The design of light gauge steel framing is based on products manufactured by
2 ClarkDietrich.
3
- 4 B. The following manufacturers are acceptable to provide products of this Section
5 provided all proposed products meet or exceed specified requirements:
6 01 Cemco
7 02 Marino/Ware
8 03 Mill Steel
9 04 The Steel Network
10 05 Telling Industries
11

12 2.2 MATERIALS

- 13
- 14 A. Light Gauge Steel Framing:
15 01 Steel Studs: Manufacturer's standard C-shaped steel studs, punched with
16 stiffened flanges, complying with ASTM C995.
17 02 Punched web with minimum 1 5/8" flanges with 1/2" inch flange return lip.
18 03 Steel Track: Manufacturer's standard U-shaped steel track, unpunched, with
19 unstiffened 1-1/4" flanges, complying with ASTM C955.
20 04 Steel Deflection / Top Track: Manufacturer's standard 16 gauge deep-leg U-
21 shaped steel track, unpunched, with unstiffened 2-inch flanges. Flanges may
22 be slotted to accommodate movement in the stud-to-top-track connection.
23
- 24 B. Provide steel framing accessories of the same material and finish used for framing
25 members, Grade 33.
26 01 Accessories include bracing, bridging, blocking, gusset plates, diagonal strap
27 bracing, kicker and knee braces indicated, or required to provide a complete
28 steel framing system to withstand design loads indicated on the Structural
29 Drawings.
30
- 31 C. Minimum thickness for any / all light gauge steel framing shall be 54 mil, ASTM
32 A653/A653M, Grade A, 33,000 psi minimum yield (FY).
33
- 34 D. Minimum member size for general framing shall be 6"; unless specifically shown
35 otherwise on the Drawings or required per reviewed Shop Drawings.
36
- 37 E. Minimum Material Thicknesses / Mils for Uncoated Steel:
38 01 16 gauge: 54 Mil
39 02 14 gauge: 68 Mil
40 03 12 gauge: 97 Mil
41
- 42 F. Light Gauge Steel Framing Properties: The following table lists minimum criteria for
43 various member sizes and thicknesses:
- | | <u>Stud Size</u> | <u>Stud Mil</u> | <u>Min Sx</u> |
|----|--|-----------------|---------------|
| 44 | | | |
| 45 | 01 2-1/2" | 54 | 0.306 |
| 46 | 02 2-1/2 | 68 | 0.372 |
| 47 | 03 3-5/8" | 54 | 0.485 |
| 48 | 04 3-5/8" | 68 | 0.610 |
| 49 | Note: above only allowed at structural infill, furring and other locations
50 specifically shown on the Drawings. | | |
| 51 | 05 6" | 54 | 0.953 |
| 52 | 06 6" | 68 | 1.18 |
| 53 | 07 8" | 54 | 1.43 |
| 54 | 08 8" | 68 | 1.77 |
| 55 | 09 10" | 54 | 1.99 |
| 56 | 10 10" | 68 | 2.47 |

11	12"	54	2.62
12	12"	68	3.25

G. Gauge equivalent products shall not be accepted – no exceptions.

H. Light Gauge Steel Framing Properties: The following table lists maximum laterally-unbraced heights for exterior wall framing members spaced 16" O.C. and a maximum deflection of L/360: *Note: the following is based on 25 PSF wind load and may not apply to TDI wind zone areas – CONFIRM with structural engineer.*

	<u>Stud Size</u>	<u>Stud Mil</u>	<u>Max UB Ht.</u>	<u>ClarkDietrich No.</u>
01	6"	54	17'-6"	600S162-54 P
02	6"	68	18'-9"	600S162-68 P
03	8"	54	21'-11"	800S162-54 P
04	8"	68	23'-8"	800S162-68 P
05	10"	54	26'-0"	1000S162-54 P
06	10"	68	28'-2"	1000S162-68 P
07	12"	54	32'-11"	1200S162-54 P
08	12"	68	35'-10"	1200S162-68 P

I. Fastenings:

- 01 Stud-To-Track Fasteners: Self-Drilling Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized ASTM A653 or Dagger-Guard coated.
- 02 Sized and detailed per engineered Shop Drawings.
- 03 Track Anchorage Devices: Power-driven or powder-actuated, drilled expansion bolts; or screws with sleeves; sized and detailed per engineered Shop Drawings.
- 04 Welding: AWS D1.3; sized and detailed per reviewed Shop Drawings.

J. Miscellaneous Materials:

- 01 Provide angle clips, bracing, etc. as required to connect light gauge steel framing to structural steel framing.
- 02 Miscellaneous materials shall be the same gauge, or heavier, as the light gauge steel framing is used on.

K. Finish:

- 01 Provide minimum G60 galvanized coating per ASTM A653 and ASTM C995.
- 02 Touch-up all field welds with inorganic zinc-rich primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal framing systems in accordance with the engineered Shop Drawings and calculations, and manufacturer's installation instructions.

B. Fastening of components shall be by means of approved self-drilling screws or welding.

- 01 Screw and welds shall be of sufficient size to ensure strength of connection.
- 02 All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structure".
- 03 All light gauge steel studs shall be fastened to the bottom and top track at both the inboard and outboard track flanges.

C. Runner Tracks: Install continuous tracks to match associated light gauge steel framing members.

- 01 Align tracks accurately to layout at base and tops of studs.

- 1
2
3
4
5
6
7
8
9
10
11
12
- 02 Secure tracks as recommended by stud manufacturer, except do not exceed 24 inches O.C. for screw or power-driven fasteners and shall not exceed 16 inches O.C. for other types of attachment.
 - D. Unless otherwise shown, space studs a maximum of 16 inches O.C.
 - 01 Space studs less than 16" O.C. in accordance with reviewed Shop Drawings.
 - E. At a minimum, install continuous, horizontal bridging at mid-height in walls up to 10 feet high, and at 5'-0" O.C. maximum in walls over 10 feet high.
 - 01 All bridging shall be welded.
 - F. Coordinate with other trades as required for proper installation of interfacing work.

13 **3.2 TOLERANCES**

- 14
15
16
17
18
19
20
21
22
23
24
- A. Install exterior wall framing within 1/4 inch plumb over the full height of the wall.
 - B. Maintain a straight, true wall within 1/4 inch per 40 linear feet length, non-cumulative.
 - C. Coordinate exact heights required to accept wood blocking, etc. required for the proper installation and interface with work of other trades.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide miscellaneous metal fabricated materials and assemblies as indicated on the Drawings.
 - 02 Provide metal fabrications as required to complete all structural steel framing.
 - 03 Coordinate with other trades as required to provide all necessary metal fabrications required to install and interface with their work.
- C. Related Work:
 - 01 Section 05 31 00 – Steel Decking
 - 02 Section 05 51 00 – Metal Stairs
 - 03 Section 05 52 13 – Pipe and Tube Railing
 - 04 Section 07 95 00 – Expansion Joint Covers

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements where applicable.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM A36 - Structural Steel.
 - 02 ASTM A123 / A123M – Standard Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - 03 ASTM A153 / A153M - Standard Specifications for Zinc (Hot-Dip) on Iron and Hardware.
 - 04 ASTM A307 - Carbon Steel Externally and Internally Threaded Standard fasteners.
 - 05 ASTM A385 - Providing High-Quality Zinc Coating (Hot Dip).
 - 06 ASTM A325 - High Strength Bolts for Structural Steel.
 - 07 ASTM A500 - Cold formed welded and seamless carbon sheet structural tubing in rounds and shapes.
 - 08 ASTM A992 - Steel for Structural Shapes for use in Building Framing.
 - 09 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- B. American Institute of Steel Construction:
 - 01 Steel Construction Manual, 15th Edition.
- C. American Welding Society:
 - 01 American Welding Society Structural Welding Code D11.1-77.
- D. American Iron and Steel Institute:
 - 01 Specification for Design Fabricated and Erection of Cold Formed Steel.
- E. Federal Specification: Fed. Spec. TT-P-664 and MIL-P-53030.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS

- A. Structural Steel: Comply with ASTM A36.
- B. Welding: Comply with American Welding Society Code.
- C. Bolts:
 - 01 Comply with ASTM A307.
 - 02 Size: 3/4 inch, unless otherwise noted.
 - 03 Bolts used to fasten roof perimeter blocking to steel framing shall be carriage type bolts.

- D. Anchors:
- 01 Expansion Bolts:
 - a. Rawl Calk-Ins or Arrow Series 4000, 1/4 inch or less.
 - b. Rawl Multi-Calks - greater than 1/4 inch. Top shall be 1/2 inch below concrete surface.
 - 02 Molly Screw Anchors:
 - a. In walls 1/16 - 5/8 inch thick, use "S" length.
 - b. In walls 5/8 - 1 1/4 inch thick, use "L" length.
 - c. In walls 1 1/4 - 1 3/4 inches thick, use "XL" length.
- E. Shop Priming:
- 01 Shop coat any ungalvanized ferrous metal with primer.
 - 02 Clean iron and metal to be primed of scale, dirt and dust by steel scrapers, wire brushers or sandblasting. Remove oil and grease with petroleum naptha.
 - 03 Thoroughly work paint into all joints by brush. Overall application of brush or spray coat of red lead primer per Fed. Spec. TT-P-86.
 - 04 Give any painted built-in portions one field coat of primer on all abraded parts after installation.
- F. Galvanized Metal:
- 03 Comply with ASTM A123.
 - 04 General: Galvanized all steel sections which are fully or partially exposed to weather, regardless if they are scheduled to receive a finish coat of paint or not.
 - 05 Galvanized items to be painted shall be primed as outlined in Section 09 91 00 - Painting and Staining.
 - 06 Hot-dip galvanized after fabrication.
 - 07 Silicone protective coating shall not be used at galvanized items scheduled to receive paint.
- G. Aluminum:
- 08 Extruded sections from alloy 6063-T52, meeting the requirements of ASTM B221.
Clear anodized finish samples to be submitted for approval on each item.
Submit sample of finish weld.
 - 09 Custom fabricate as shown on the Drawings. Grind all welds smooth and flush to match adjoining exposed surfaces. Provide cast wall brackets - Julius Blum #376.
 - 10 All fasteners shall be stainless steel with tamper proof bolts and no pop rivets. Provide flush counter sunk heads.
 - 11 All pipe rails shall be Schedule 40 and have welded connections with male/female splice connections, and have a completely smooth flush finish. All corners and angles shall be custom prefabricated. All splices shall occur at supports.
 - 12 Exterior rails shall be all welded construction.
 - 13 Provide clear epoxy coating where aluminum is in direct contact with concrete (only).

2.2 MISCELLANEOUS METAL ITEMS

- A. The following is a list of the principal miscellaneous metal items to be furnished under this Section. This list is offered only as a guide and Contractor shall thoroughly check Drawings for other miscellaneous metals.
- 01 All steel items exposed to the exterior shall be hot-dip galvanized after fabrication.

- B. Fixed Pipe Bollard / Guard Post:
- 01 Provide and install 4" Schedule 40 steel pipe bollard / guard post, as detailed on the Drawings.
 - 02 Provide casting anchors welded to the bollard as indicated on the Drawings.
 - 03 Hot dip galvanized after fabrication.
 - 04 Fill with concrete after installation, crowned at top.
- C. Removable Pipe Bollard / Guard Post:
- 01 Provide a 4" Schedule 40 galvanized steel pipe bollard / guard post with 3/8" welded cap plate, as detailed on the Drawings.
 - 02 Provide and install 5" Schedule 40 galvanized steel pipe sleeve in as detailed on the Drawings.
 - 03 Provide casting anchors welded to the bollard sleeve as indicated on the Drawings.
 - 04 Provide 2x2x1/4 x 1-1/2" steel angles on each pipe, positioned to mate at fully installed bollard; angles punched to receive a padlock to prevent removal.
 - 05 Hot dip galvanized after fabrication.
- D. Steel Handrails & Brackets:
- 06 Furnish and install 1-1/2" O.D. Schedule 40 steel pipe rails and handrails in configurations as indicated on the Drawings.
 - 07 Multi component handrail systems shall have welded connections.
 - 08 All exposed open ends shall have welded domed caps.
 - 09 Design of wall brackets is based on Julius Blum # 306 3" offset handrail brackets; or equal approved by the Architect.
 - 10 Maximum handrail bracket spacing shall be 72" unless shown otherwise on Drawings
 - 11 Include all other parts required for finished installation.
 - 12 Handrail assemblies at exterior locations shall be hot-dipped galvanized after fabrication.
 - 13 All work shall be in accordance with ADA and Texas Accessibility Standards.
- E. Steel Ladders:
- 01 Provide steel ladders at all roof hatch locations.
 - 02 Fabricate from steel shapes:
 - a. Stringers: 3/8" x 3" steel plate.
 - b. Rungs: minimum 1" diameter steel bars; 12" maximum spacing.
 - c. Anchor stand-off brackets: minimum 3" x 6" x 1/4" steel angles or bent plate; locate one (1) at base of ladder anchored to floor slab; and at maximum 48" O.C. above, anchored to wall.
 - 03 Weld joints and grind smooth.
 - 04 Coordinate with roof hatch provider / installer as required for proper interface.
- F. Loose Lintels at Masonry Veneer:
- 01 Fabricate from steel angles as shown on the Drawings.
 - 02 Refer to Structural Drawings for angle sizes relative to opening widths.
 - 03 Use continuous lengths wherever possible.
 - 04 Hot dip galvanize after fabrication.
- G. Masonry Anchors at Steel Columns:
- 01 Fabricate from 5/16" diameter steel, galvanized after fabrication.
 - 05 Field weld to columns, space not more than 24" O.C. vertically to coincide with horizontal mortar joint elevations.

- 06 Refer to Structural Drawings.
- H. Exterior Cast-In-Place Trench Covers and Frames:
- 01 Design is based on Balco TSA Series – Abrasive Infill Plate.
Design is based on Balco TSD Series – Diamond Plate.
Design is based on Balco TSP Series – Smooth Plate.
 - 02 Additional Acceptable Manufacturers:
 - a. Architectural Art Manufacturing.
 - b. MM Systems Corp.
 - 03 All aluminum trench cover comprised of an extruded aluminum frame and aluminum cover plate.
 - 04 Aluminum Extrusions: 6063-T%, ASTM B221.
 - 05 Aluminum Plate: 5052-H32, ASTM B209.
 - 06 All surfaces in contact with concrete shall have a factory applied, protective coating.
 - 07 Width: Standard manufacturer's width as indicated on the Drawings.
 - 08 Aluminum Plate:
 - a. 1/4" up to 6" width.
 - b. 3/8" up to 16" width.
 - c. 1/2" in vehicle traffic areas.
 - 09 Fabricate frame and plates to fit trench length indicated on the Drawings.
- I. Interior Trench Covers and Frames:
- 01 Design is based on Balco Series TST interior trench frame and cover suitable for insertion of resilient flooring.
 - 02 Additional Acceptable Manufacturers:
 - a. Architectural Art Manufacturing.
 - b. MM Systems Corp.
 - 03 Aluminum plate shall be minimum 1/4 inch thick with a recessed design to accept VCT floor tile.
 - 04 Frame shall be set 1/8 inch above concrete floor so that the finished top is flush with the finished VCT floor.
 - 05 See Exterior Cast-In-Place Trench Covers and Frames for additional information.
 - 06 Additional Acceptable Manufacturers:
 - a. Architectural Art Manufacturing.
 - b. MM Systems Corp.
- J. Window Frame Head Supports:
- 01 Construct frame supports for all aluminum entrances and storefront / curtain walls as detailed and required for a rigid assembly of the aluminum framing.
 - 02 Refer to Structural Drawings.
 - 03 Fabricate and install to provide anchoring of 2x treated wood blocking at head of aluminum entrances and storefront / curtain walls.
- K. Miscellaneous Angles:
- 01 Sizes and shapes as detailed.
 - 02 Use specified galvanized steel for angles at exterior conditions.
- L. Below and Above-Ceiling Supports:
- 01 Construct of Unistrut members or as approved by Architect to size and shape required to mount and support the associated equipment or assembly.
 - 02 Coordinate with other trades as required.
 - 03 Suspended assemblies shall be secured to structure above with minimum 1/4" steel rods; threaded as required.
 - 04 All work shall be accurate to +/-1/4".

- 05 Provide supports complete with fastenings to structure for overhead equipment.
- M. Miscellaneous Items:
 - 01 Miscellaneous metal items and their related components are not necessarily individually described.
 - 02 Miscellaneous items not described shall be furnished and installed in accordance with the intent of the Drawings and Specifications, and as required to complete the Work.
 - 03 Coordinate with other trades as required.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate all trades as required for proper interface of miscellaneous steel and interfacing work.
 - 01 Concrete foundations at embedded work.
 - 02 Blocking in walls for wall mounted work.
 - 03 Steel supports as required.
 - 04 Coordination with building finishes.

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and final reviewed submittals.
- B. Separate all dissimilar metals.
- C. Where welding is exposed to view, welds shall be executed neatly then ground smooth. Pits and blemishes are not acceptable.
- D. For manufactured items, adhere to printed manufacturer's installation instructions.
- E. Refer to Section 09 91 00 – Painting and Re-painting for items that are to receive paint.

END OF SECTION

SECTION 05 52 13

PIPE AND TUBE RAILING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide exterior pipe handrail assemblies at ramps, steps and stairs as indicated on the Drawings.
 - 02 Handrail materials – steel, galvanized steel, aluminum or stainless steel - shall be identified on the Drawings for each location.
- C. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Section 05 50 00 – Metal Fabrications
 - 03 Section 09 91 00 – Painting and Re-Painting

1.2 SUBMITTALS

- C. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- D. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- E. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- F. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- G. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

- H. Color / Finish Samples:
- 01 Provide two (2) samples of each product proposed to be furnished for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. ASTM International:
- 01 ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 02 ASTM A123 / 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - 03 ASTM A269- Standard Specification for seamless and welded austenitic stainless steel tubing.
 - 04 ASTM A276- Standard Specification for stainless and heat resisting bars and shapes.
 - 05 ASTM A312- Standard Specification for seamless and welded austenitic stainless steel pipe
 - 06 ASTM B26 / B26M - Standard Specification for Aluminum-Alloy Sand Castings
 - 07 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
 - 08 ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
 - 09 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
 - 10 ASTM B429- Standard Specification for aluminum structural pipe and tube.
 - 11 ASTM E894- Standard Test Methods for anchorage of permanent metal railing systems and rails for buildings.
 - 12 ASTM E935- Standard Test Methods for performance of permanent metal railing systems and rails for buildings.
 - 13 ASTM E985- Specifications for permanent metal railing systems and rails for buildings
 - 14 ASTM F3125 - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 KSI and 150 KSI Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
- B. American Welding Society (AWS) – Latest Editions:
- 01 AWS D1.1 - Structural Welding Code Steel..
 - 02 AWS D1.2 - Structural Welding Code Aluminum.
 - 03 AWS D1.6 - Structural Welding Code Stainless Steel.
 - 04 AWS B2.1-84 - Welding procedure and performance calculations.
- C. American Institute of Steel Construction (AISC)
- 01 AISC 360-16 - 2016 AISC Specifications for Structural Steel Buildings.
- D. Architectural Aluminum Manufacturers Association (AAMA)
- 01 AAMA 605.1- Specification for high performance organic coatings on architectural extrusions and panels.
 - 02 AAMA 606.1- Voluntary guide specifications and inspection methods of integral color anodic finishes for architectural aluminum.
 - 03 AAMA 607.1- Voluntary guide specifications and inspection methods for clear anodic finishes for architectural aluminum.

PART 2 - PRODUCTS

2.1 GENERAL MATERIALS - STEEL

- A. Exterior Pipe:
 - 01 Welded and seamless steel type, ASTM A53, Type S, Schedule 40
 - 02 Finish: Hot dipped galvanized in accordance with ASTM A123 / A123M.
- B. Bolts, Nuts and Washers: High strength steel type, ASTM F3125.
- C. Brackets, Flanges and Anchors: Cast or formed metal of the same type of material and finish used for railing.
- D. Welding Materials: Applicable AWS D1.1, type required for materials being welded.
- E. Wire Mesh: Design is based on McNichols Square Carbon Steel Lock Crimp Woven Wire Mesh; or equal accepted by the Architect.
 - 01 Mesh Size: Nominal 0.50" x 0.50"
 - 02 Wire Gauge: 11
 - 03 Open Area: 65%
- F. Finish as indicated on the Drawings.
 - 01 Refer to Section 09 91 00 – Painting and Repainting for painted finishes.

2.2 GENERAL MATERIALS – GALVANIZED STEEL

- A. Same steel materials specified above in 2.1.
- B. All components and assemblies shall be hot-dipped galvanized.
 - 01 For welded assemblies, hot-dip galvanize after fabrication.
- C. Brackets, Flanges and Anchors: Cast or formed metal of the same type of material and finish used for railing.
- D. Wire Mesh: Design is based on McNichols Square, Hot-Dipped Galvanized, Welded Mesh; or equal accepted by the Architect.
 - 01 Mesh Size: Nominal 0.46" x 0.46"
 - 02 Wire Gauge: 19
 - 03 Open Area: 84%
- E. Finish as indicated on the Drawings.
 - 01 Refer to Section 09 91 00 – Painting and Repainting for painted finishes.

2.3 PIPE RAILING SYSTEM

- A. Provide in configurations and profiles as indicated on the Drawings.
- B. All handrail systems shall be fabricated and installed in accordance with Texas Accessibility Standards (TAS) and Americans With Disabilities Act (ADA).
- C. Posts, Top Rail and Handrails: 1-1/2" diameter
- D. Infill Horizontal Diagonal Rails: 1 1/4" diameter
- E. Wall Brackets: Design is based on products manufactured by Wagner; or equal as accepted by the Architect

- 01 Wall Brackets: design is based on Wagner model RB14130 style wall mount handrail bracket in material to match handrail system materials.
- 02 Pipe Brackets: provide similar style as wall brackets, specifically configured to mount / adapt to mounting on pipe rail.
- 03 Type: 5/8" diameter bar bend
- 04 Projection: 3-1/4" from wall to center of handrail
- 05 Finish: Match handrail system finish
- F. Provide infill woven mesh where indicated on the Drawings.
 - 01 Woven mesh shall be secured to pipe railing with a continuous U-shape receiver securely fastened to pipe railing.
- G. Painted Finish at Interior Railings:
 - 01 Shop primed.
 - 02 Refer to Section 09 91 00 – Painting and Repainting for painted finishes.
- H. Painted Finish at Exterior Railings:
 - 01 No finish required.

2.4 GENERAL FABRICATION

- A. Verify dimensions on site prior to shop fabrication.
- B. Fabricate integral railings and component connections capable of resisting a lateral force of 150 lbs. minimum, at any single point, without permanent set or damage.
- C. Fit and shop assemble sections in largest practical sizes.
- D. Accurately form and fit components and connections.
 - 01 All steel connections shall be cut to fit and welded continuous.
 - 02 Grind exposed edges and welds smooth and flush.
 - 03 All aluminum connections shall be fitted with flush connectors or welded.
- E. Accurately form components required for proper anchorage of stairs, landings and integral railings to each other and to building structure.
- F. Thoroughly clean steel surfaces of rust, scale, grease, and foreign matter prior to prime painting. Allow to dry thoroughly before applying priming materials.
- G. Shop prime in two coats having a total dry film thickness of 2.0 mils. Do not prime surfaces to be field welded or cast in concrete.

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect handrails square, level, plumb and free from distortion or defects detrimental to appearance and performance.
- B. Provide necessary anchors, plates, and sleeves as required for connecting handrail to the structure.
- C. Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.

- D. Perform necessary cutting and altering for the installation of work of other sections. Do not perform any other additional cutting without the review of the Architect.
- E. Field bolt and weld to match standard of shop bolting and welding.
 - 01 Conceal bolts and screws whenever possible.
 - 02 If bolts and screws are not concealed, use flush countersunk fastenings.
 - 03 Make mechanically fastened joints flush (hairline or better).
 - 04 Grind welds smooth and flush.

END OF SECTION

SECTION 06 10 13

ROUGH AND FINISH CARPENTRY

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - :
 - 01 Provide blocking in metal framed drywall partitions and other assemblies as required for the secure attachment of built-in assemblies / products and assemblies / products that anchor to drywall partitions.
 - 02 Provide blocking at all door and window openings in exterior walls as indicated on the Drawings
 - 03 Coordinate with all trades and material suppliers to ascertain blocking requirements.
 - 04 Provide finish wood materials as required in documents
- C. Related Work:
 - 01 Division 7 Roofing and Roof Accessories
 - 02 Division 8 – Doors, Windows and Glazing

1.1 SUBMITTALS

- A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Test Reports: Certified test reports showing compliance with the specified performance characteristics and properties.
- D. Certificates: Certification from the treatment plant certifying wood treatment applied complies with the criteria and physical requirements for ACQ preservative-treated wood products as specified herein.
- E. Shop Drawings:
 - 01 Complete shop drawings for the Architect's approval.
 - 02 Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
 - 03 Manufacturer's installation instructions.

1.2 STANDARDS AND GRADING

- A. All lumber used structurally shall be graded and marked with grade and trademark of a lumber grading organization approved by the Architect, except that a certification of grade from such a grading organization may be accepted in lieu of grade and trademarks when approved by Architect. Trademark of manufacturer shall also appear on each piece.
- B. Each piece of plywood used structurally shall carry the American Plywood Association trademark.
- C. Grading Rules: Conform with all applicable requirements of American Lumber Standards "Simplified Practice Recommendations R-16" and to grading rules of manufacturer's association under whose rules the lumber is produced.
- D. Reference Standards: (Conform with all requirements)
 - 01 U.S. Dept. of Commerce Product Standards
 - 02 American Wood Preservers Assoc. Standards (as they apply)
 - 03 Architectural Woodwork Institute "Quality Standards"
 - 04 Western Wood Products Association Manual
- E. Architectural Woodwork Institute "Quality Standards".
- F. National Fire Protection Association
 - 01 NFPA 285 – Standard Fire Test Methods for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Materials
- G. Western Wood Products Association Manual.
- H. American Wood Preservers Association Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber:
 - 01 Framing lumber including interior studs, joists, rafters, blocking, etc., #1 kiln dried.
 - 02 Treated No. 2, S4S Southern Yellow Pine:
 - a. Comply with NWMA Standards.
 - b. Use for blocking, stripping, grounds, cants and miscellaneous wood items in contact with concrete, roofing, or exposed to the weather.
- B. Fire Retardant No. 2, S4S Southern Pine: Lumber shall be pressure-impregnated with non-combustible fire retardant chemicals in accordance with U.L. FRS Fire Hazard Classification. All lumber must be dried following treatment in accordance with AWWA Standard C-20.
- C. Preservative Wood Treatment:
 - 01 Wood products shall be treated with waterborne, alkali-based wood preservatives listed in Section 4 of AWWA Standards U1, excluding those which contain arsenic and / or chromium.
 - 02 All treated wood products not in direct contact with the ground / earth

- shall meet requirements standards of the American Wood Preservers Association (AWPA) Standard U1 for Use Category 3B.
 - 03 Copper Azole Type-C (CA-C) with minimum treatment rate of 0.06 PCF.
 - 04 Micronized Copper Azole (MCA) with minimum treatment rate of 0.06 PCF.
 - 05 Use galvanized fasteners where not exposed to direct moisture. Use stainless steel fasteners where exposed to direct moisture.
- D. Fire Retardant Pressure Treatment of Lumber and Plywood
 - 01 Lumber: Comply with AWPA U1 UCFA, Type A or ICC-ES ESR 2645.
 - 02 Plywood: Comply with AWPA U1, UCFA, Type A or ICC-ES ESR 2645.
 - 03 Surface Burning Characteristics: UL FR-S rating; or flame spread and smoke developed ratings of 25 or less in a test of 30 minutes' duration in accordance with IBC section 2303.2.
 - 04 Kiln dry after treatment to 19 percent maximum moisture content for lumber and 15 percent for plywood
 - 05 Treatment: Viance "D-Blaze FRT"; Dricon "Dricon FRT"; or approved equal.
 - 06 Provide fire retardant wood where ever part of a fire rated assembly; where required by code; and where required by local jurisdiction.
 - 07 Provide fire retardant wood in exterior wall assemblies as required to meet NFPA 285 requirements.
- E. Treated Wood Isolation: All treated material shall be installed with an isolation sheet between the wood and adjacent metal surface.
 - 01 Provide 15 lb. asphalt impregnated building felt or other isolation material as recommended by the treatment manufacturer.
- F. Interior Trim:
 - 01 Natural: Premium sliced Red Oak conforming to AWI Quality Standard 300-3 for transparent finish. Boards shall be selected for compatibility of grain. No mineral streaks permitted. Use for miscellaneous natural finish trim.
- G. Plywood:
 - 01 General: Comply with APA Standards.
 - 02 APA A-D, Group 1 Interior. Used where appearance of only one side is exposed to view for interior locations.
 - 03 Exterior plywood, Group 1, APA rated sheathing. Use where miscellaneous plywood is exposed to concrete or weather.
 - 04 Fire Retardant Treated Plywood - Identical to "C.03" with pressure-impregnated non-combustible fire retardant chemicals in accordance with U.S. FRS Fire Hazard Classification, AWPA Standards C-27. Use when required by building code or noted on drawings.
 - 05 Flooring Underlayment: APA rated Sturdi-floor, exterior grade, tongue and groove edges.
- H. Rough Hardware:
 - 01 Nails, Spikes, and Staples:
 - a. Galvanized for exterior locations, high humidity locations, treated wood not directly exposed to moisture, and fire retardant treated wood.
 - b. Type 304 or 316 stainless steel for for treated wood directly exposed to moisture.
 - c. Plain finish for other interior locations.

- d. Use largest size and type to suit application.
- 02 Bolts, Nuts, Washers, Lags, and Screws:
 - a. Medium carbon steel, A-307 or A-325; size and type to suit application if not noted on the Drawings.
 - b. Galvanize for exterior locations, high humidity locations, treated wood not directly exposed to moisture, and fire retardant treated wood.
 - c. Type 304 or 316 stainless steel for treated wood directly exposed to moisture.
 - d. Plain finish for other interior locations.
 - e. Carriage bolts shall be used to connect roof edge wood blocking to the steel perimeter angle.
- 03 Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry and concrete. Bolts or power activated type for anchorage to steel.
- I. Sheet metal Blocking:
 - 01 Sheetmetal blocking may be an acceptable alternative to wood blocking for wall attached equipment and assemblies.
 - 02 Minimum Size: 16 gauge x 6" height sheetmetal.
 - 03 Pre-galvanized or hot-dipped galvanized material.
 - 04 Sheetmetal blocking shall be continuous, and extend to the next stud beyond the equipment or assembly.
- J. Technology / Punch-Down Boards:
 - 01 Use grade stamped DFPA, grade A/D.
 - 02 Provide 4' x 8' sheets of 3/4 inch plywood for telephone boards in mechanical rooms; telephone rooms and other areas where needed for attachment of equipment of other trades.
 - 03 Provide 3/4 inch plywood up to 8'-0" above finish floor behind finished gyp board at all walls of the technology Head End Room (alternate names include M.D.F. Room, Building Demarcation Room)
 - 04 Provide 3/4 inch plywood up to 8'-0" above finish floor behind finished gyp board at all wall(s) in IDF Rooms where wall mounted equipment is indicated..
 - 05 Where exposed, paint as scheduled in Section 09900

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Blocking in metal framed drywall partitions shall be required at, but not limited to the following locations:
 - 01 All recessed or semi-recessed equipment and assemblies
 - 02 All wall hung surface equipment and assemblies.
 - 03 All wall attached equipment and assemblies.
 - 04 Other equipment or assemblies as recommended by the manufacturer for proper installation.
- B. Wood Blocking:
 - 01 Use standard 2x lumber materials for blocking, nailers and other similar applications. Provide 1x materials where indicated or necessary to achieve the required thickness.
 - 02 Rip, chamfer and / or cut material as required fit the application /

- assembly.
- 03 Non-continuous blocking supporting continuous 2x blocking or nailers shall be a minimum of 16" long and installed so the maximum gap is 24".
 - 04 Blocking at all recessed equipment and fixtures shall be continuous all sides.
 - 05 Bolt nailers and blocking to steel, masonry or concrete members with bolts or proportionate strength of members attached from each end, except as otherwise noted on plans.
 - 06 Blocking Locations: Provide wood blocking at all built-in work, in walls for anchoring cabinets, and other locations as indicated on the drawings.
 - 07 Provide blocking, bucks and framing as necessary and for other trades as required.
- C. Roof Edge Wood Blocking:
- 01 Provide continuous wood blocking at roof perimeter as indicated on the Drawings.
 - 02 Anchor to steel perimeter angle at 24" O.C. maximum using a 3/8" minimum carriage bolt, inserted from the underside of the perimeter angle.
 - 03 Counter-sink wood blocking 3/4" maximum depth to accommodate the bolt washer, nut and any protruding thread.
 - 04 Size length of bolt to not protrude above the top surface of the wood blocking.
- D. Plywood:
- 01 Install plywood over framing in accordance with instruction of American Plywood Association Construction Guide Form No. E30C.
 - 02 Install underlayment plywood in accordance with instructions of American Plywood Association.
 - 03 Space panel joints and edges 1/32 inch.
 - 04 Fill and sand panel edge joints, surface roughness, and damaged or open areas.
 - 05 Fasten with screws spaced at 6 inches at edges and 8 inches in field each way.
- E. Sheet metal Blocking
- 01 Contractor shall submit requested locations or conditions proposed to use sheetmetal blocking to the Architect for review and acceptance.
 - 02 Where accepted, sheetmetal blocking shall be fastened / screwed to each metal stud in a minimum of two (2) locations per stud. Use standard drywall screws for fasteners.
- F. Spiking and nailing shall be done using largest size spikes and nail practicable.
- G. Bolt nailers and blocking to steel, masonry or concrete members with bolts or proportionate strength of members attached from each end, except as otherwise noted on Plans.
- H. Provide solid wood blockings between metal stud framing for wall-mounted items, such as toilet partitions, toilet accessories, cabinets, handrail's, etc.

END OF SECTION

SECTION 07 13 63

SHOWER STALL WATERPROOFING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide liquid membrane waterproofing at all job-built (non-prefabricated) shower stalls.
- C. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Section 09 21 16 – Gypsum Board Assemblies
 - 03 Section 09 30 13 – Ceramic Tiling

1.2 SUBMITTALS

- C. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- D. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- F. Manufacturer's sample warranty.

1.3 REFERENCES

- A. ANSI A118.10 – Standard Specifications for Load Bearing, Bonded, Waterproof Membrane for Thin-Set Ceramic Tile and Dimension Stone Installation.
- B. ANSI A118.12 – Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- C. IAPMO – International Association of Plumbers and Mechanical Officers standards and recommendations.

1.4 WARRANTY

- A. Warrant the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to the following:
 - 01 Leaking.
 - 02 Releasing from substrate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design is based on Laticrete Hydro Barrier Membrane Waterproofing System.
- B. Acceptable Manufacturers: The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 Mapei International
 - 02 NAC Products
 - 03 Noble Company

2.2 MATERIALS

- A. Material shall be a load bearing, self-curing, liquid applied rubber polymer suitable for use at exterior and interior locations.
- B. System shall be comprised of liquid applied rubber polymer used in conjunction with reinforcing fabric applied at all cracks, floor / wall transitions, wall substrate joints and other vertical transitions.
- C. Physical Properties: product shall meet or exceed the following:

01	7-Day Hydrostatic Test	ANSI A118.10	Pass
02	7-Day Tensile Strength	ANSI A118.10	265 – 300 PSI
03	7-Day Water Emersion	ANSI A118.10	95 – 120 PSI
04	7-Day Shear Bond	ANSI A118.10	200 – 275 PSI
05	System Crack Resistance Test	ANSI A118.10	Pass
06	Water Vapor Transmission	ASTM E-96	0.515 Grs./Hr./SF
07	Water Vapor Performance	ASTM E-96	1.247 Perms
08	System Performance	ANSI A118.10, ASTM C627	Cycles 1-14 - Heavy Duty

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate work with other trades (plumbing and tile) as required for proper installation of shower stall waterproofing.
- B. Surface temperature must be 50°F to 90°F (10°C to 32°C) during application and for 24 hours after installation.
- C. All substrates must be structurally sound, clean and free of dirt, oil, grease, paint, laitance, efflorescence, concrete sealers or curing compounds.

- D. Make rough or uneven concrete smooth to a wood float or better finish with a LATICRETE underlayment. Do not level with gypsum or asphalt-based products.
- E. Maximum deviation in plane must not exceed 1/4" in 10 ft (6 mm in 3 m) with no more than 1/16" in 1 ft (1.5 mm in 0.3 m) variation between high spots.
- F. Dampen hot, dry surfaces and sweep off excess water—installation may be made on a damp surface.
- G. New concrete slabs shall be damp cured and a minimum of 14 days old before application.

3.2 INSTALLATION

- A. Locations: Install under conventional tile in the shower stalls.
- B. Pretreat all cracks, floor-to-wall transitions, penetration and floor drains with reinforcing fabric per manufacturer's standards and recommendations.
- C. Reinforcing fabric shall be a minimum 5" wide; and wider where applicable to the condition.
- D. Install reinforcing fabric in continuous lengths for the applicable condition / joint.
- E. Allow any pre-treated areas to dry to the touch.
- F. Apply a liberal coat of liquid membrane material with brush or roller over substrate including pre-treated areas.
- G. Apply another liberal coat of liquid membrane material over the first coat.
- H. Let topcoat dry to the touch, approximately 1–3 hours at 70°F (21°C) and 50% RH; or as recommended by the manufacturer.
- I. When last coat has dried to the touch, inspect final surface for pinholes, voids, thin spots or other defects. Use additional liquid membrane material to seal defects.
- J. All coat thicknesses and finished application thickness shall as be recommended by the manufacturer; but in no case shall be less than 0.030".
- K. Prior to completion, coordinate with tiling contractor to inspect the installation for acceptability for their work to proceed. Repair and / or replace areas that are not acceptable.
- L. The completed installation shall form a continuous, waterproof membrane at ceramic tile substrates throughout the entire shower stall.

END OF SECTION

SECTION 07 19 00

WATER REPELLENTS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Water Repellant shall be applied to exterior masonry veneer, stone veneer and cast stone that does not receive a painted finish.
- B. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 04 42 00 – Exterior Stone Cladding
 - 03 Section 04 72 00 – Cast Stone Masonry

1.2 SUBMITTALS

- C. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- D. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- G. Manufacturer's sample warranty.

1.3 REFERENCES

- A. American Standards for Testing materials (ASTM):
 - 01 ASTM D-5095 – Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments.
 - 02 ASTM D3278-96 – Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus.

1.4 WARRANTY

- A. Provide manufacturer's five (5) year full system warranty against failure.
- B. Manufacturer shall provide representation on site during application to confirm product is being installed in accordance with all requirements and as required for issue of specified warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design is based on products manufactured by Prosoco Company.
- B. The following manufacturers are acceptable for use for this Section, provided all specified requirements are met or exceeded.
 - 01 Applied Technologies
 - 02 ChemMasters
 - 03 SaverSystems
 - 04 Tnemec

2.2 MATERIALS

- A. Design of masonry water repellent is based on Prosoco Sure Klean Weather SealSL 100 Water Repellent.
- B. The material shall be a silane system that provides an invisible water-repellent protection.
- C. The material shall be compatible for application on masonry, stone and cast stone materials.
- D. Meets or exceeds requirements of ASTM D5095 and ASTM D3278.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that all masonry and stone work is complete, acid cleaned, and free of excess mortar and defects prior to installation of masonry water repellent.

3.2 INSTALLATION

- A. Vertical Application Instructions:
 - 01 Apply water repellent with a low-pressure sprayer, starting at the bottom of the wall and working upward.
 - 02 Saturate surface with water repellent in a single application without atomizing product. Use enough to thoroughly wet the surface.
 - 03 Thoroughly brush heavy runs and drips into the surface.
- B. Horizontal Application Instructions:
 - 01 Saturate in a single application without atomizing product. Use enough to keep the surface wet for 30 to 60 seconds before penetration.
 - 02 Broom out puddles until they penetrate the surface.

- C. Porous Surfaces:
 - 01 On extremely porous substrates, 2 applications of SL100 will be required. Apply the second coat a few minutes after the first coat has penetrated and appears dry; do not atomize product during application.
- D. Dense Surfaces:
 - 01 Apply a single coat without atomizing product. Use enough to completely wet the surface without creating drips, puddles or rundown.
- E. Protect all applications from rain and pedestrian & foot traffic for at least 4 hours.
- F. Cleanup: clean tools and equipment immediately with mineral spirits, denatured alcohol or equivalent cleaning solvent. Remove rundown and spills as soon as possible.

3.3 TESTING AND INSPECTING

- A. Ten (10) days after completion of this portion of the Work, at the discretion of the Architect, demonstrate by running water test that the Work of this Section will successfully repel water.
 - 01 Notify the Architect at least 72 hours in advance and conduct the test in the Architect's presence.
 - 02 By means of an outrigger, or similar acceptable equipment, place the nozzle of a 3/4 inch garden hose at a point approximately 10'-0" away from top of wall where approved by the Architect, aiming the nozzle at slight downward angle to direct full stream of water onto wall.
 - 03 Run water onto wall at full available force for not less than one (1) hour.
 - 04 Upon completion of the 1-hour period, inspect interior surfaces of wall for evidence of moisture penetration.
- B. If evidence of moisture penetration is discovered, apply an additional coat of approved water repellent to exterior surface in areas directed by the Architect. Repeat application and testing at no additional cost to the Owner, until no evidence of moisture penetration is found.

END OF SECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

SECTION 07 21 00

THERMAL INSULATION

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all thermal batt / roll insulation at light gauge metal framed exterior walls and building envelope.
 - 02 Provide acoustical sound attenuation insulation at interior partition cavities where indicated on the Drawings.
 - 03 Provide rigid foam insulation on all exterior CMU back-up walls.
 - 04 Provide rigid foam insulation on sheathing of all exterior light gauge metal framed walls.
- A. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 05 41 00 – Structural Metal Stud Framing
 - 03 Division 7 – Roofing
 - 04 Section 07 25 00 – Weather Barrier
 - 05 Section 09 21 16 – Gypsum Board Assemblies

1.1 SUBMITTALS

- C. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- D. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- E. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details.
 - 03 Show details of field fabrications, connections, and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements.
 - 05 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.
- F. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.

- 02 Generic details that do not depict actual conditions shall not be acceptable.
- G. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
- 01 Include recommended cleaning products and instructions for use.
- 02 Where applicable, provide recommended maintenance schedules and procedures.
- H. Sample / Mock-Up Panel: Sample / mock-up panel shall be 8' long x 6' high panel showing selected color range and texture, bonding, mortar color, joint shape, and quality workmanship. Include a brick expansion joint. Sample panel shall remain at the jobsite until all masonry is completed.
- 01 Panel shall be "L" shaped (4' x 4') with metal stud / drywall back-up wall on one side and CMU back-up on one side. Coordinate as required with other trades.
- 02 Once accepted by the Architect, the sample panel shall be the standard by which installed is judged.

1.2 REFERENCES

American Society for Testing and Materials (ASTM):

- 01 ASTM C209 – Standard Test Methods for Cellulosic Fiber Insulating Board.
- 02 ASTM C272 – water Absorption of Core Materials for Structural Sandwich Constructions.
- 03 ASTM C518 – Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- 04 ASTM C578 – Rigid, Cellular Polystyrene Thermal Insulation.
- 05 ASTM C665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- 06 ASTM D1621 – Compressive Properties of Rigid Cellular Plastics.
- 07 ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- 08 ASTM D1929 – Standard Test Method for Determining Ignition Temperature of Plastics.
- 09 ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
- 10 ASTM E96 – Water Vapor Transmission of Materials.

Underwriters Laboratory (UL):

- 01 UL 723 – Surface Burning Characteristics of Building Materials.

National Fire Protection Association (NFPA):

- 02 NFPA 259 – Standard Test Method for Potential Heat of Building Materials.
- 03 NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

PART 2 - PRODUCTS

2.1 MATERIALS – BATT OR ROLL - THERMAL

- A. Design of batt or roll thermal insulation is based on products manufactured by Owens-Corning.
- B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 Certaineed
 - 02 Guardian Building Products
 - 03 Johns Manville
 - 04 Knauf Insulation
 - 05 United States Gypsum
- C. Design of batt or roll thermal insulation is based on Owens-Corning Eco-Touch Unfaced Insulation.
- D. Batt or Roll Thermal Insulation:
 - 01 Inorganic glass fiber, flexible, unfaced insulation.
 - 02 R-Values: minimum R+19 at exterior walls at light gauge steel framed walls.
 - 03 Comply with Type 1 ASTM 665-84 unfaced.
 - 04 Flame Spread 25 or less.
 - 05 Provide in widths to match spacing of light gauge steel framing.
 - 06 Pins and disc securement accessories. Provide a minimum of two (2) pins at the top of each section of insulation to prevent sagging.

2.2 MATERIALS – BATT OR ROLL - ACOUSTICAL

- A. Design of batt or roll acoustical insulation is based on products manufactured by Owens-Corning.
- B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 Certaineed
 - 02 Guardian Building Products
 - 03 Johns Manville
 - 04 Knauf Insulation
 - 05 United States Gypsum
- C. Design of batt or roll acoustical insulation is based on Owens-Corning Sound Attenuation Batts 150 Insulation.
- D. Batt or Roll Acoustical Insulation:
 - 01 Unfaced inorganic glass fiber or mineral wool insulation specifically designed for noise control.
 - 02 Thickness: 2" minimum.
 - 03 Rating in typical 3-5/8" stud wall with 1 layer 5/8" gyp board each side: 47 STC minimum; 0.95 NRC.
 - 04 Flame Spread: 25 or less.
 - 05 Pins and disc securement accessories. Provide a minimum of two (2) pins at the top of each section of insulation.

2.3 MATERIALS – BATT OR ROLL – THERMAL AND MOISTURE (METAL BUILDING)

- A. Design of continuous rigid insulation is based on products manufactured by Owens Corning
- B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
- 06 Certaineed
 - 07 Guardian Building Products
 - 08 Johns Manville
 - 09 Knauf Insulation
 - 10 Bay Insulation Systems / Skyliner Liner System
- C. Metal Building roof and wall assemblies: Design of continuous insulation is based on Owens Corning OptiLiner Banded Liner System
- 11 This product shall be used behind all metal panel veneer walls and roofs.
 - 12 Thermal insulation and Moisture control system for metal building construction.
 - 13 Thermal performance to meet energy conservation code requirements.
- A.
- a. Metal roofs with thermal spacer block Double layer R-25 + R-11 with an assembly U-Factor of 0.035 minimum.
 - b. Walls – single layer in cavity R-25 Assemble) factor 0.059
- 14 Certified to be manufactured in accordance with ASTM C991.
 - 15 Liner Fabric meets ASTM 1136
 - 16 Water Vapor Sorption <2% by volume meeting ASTM C1104
 - 17 Water Vapor Permeance <0.02 Perms meeting ASTM E96
 - 18 Fungi Resistance No growth greater than comparative item ASTM C1338.
 - 19 Flame Spread: Class A flame spread, <25 ASTM E84.
 - 20 Smoke Development: <50 ASTM E84.
 - 21 With polyethylene vapor retarder liner fabric (white)
 - 22 With galvanized metal support straps (bands)

2.4 MATERIALS – CONTINUOUS RIGID INSULATION

- D. Design of continuous rigid insulation is based on products manufactured by Atlas Roofing.
- E. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
- 01 Dow Chemical Co.
 - 02 Johns Manville
 - 03 Owens-Corning
 - 04 Pactiv / Green Guard
 - 05 Rmax
- F. Metal Panel Veneers: Design of continuous rigid insulation is based on Atlas Roofing Energy Shield Pro Rigid Insulation.
- 01 This product shall be used behind all metal panel veneer walls.
 - 02 Closed cell, polyisocyanurate (polyiso) foam core faced with a reflective 12 mil reinforced foil facers on one side and a white 12 mil reinforced acrylic-coated aluminum facer on the other.
 - 03 Classified Type X in accordance with ASTM C578.
 - 04 Certified to comply with NFPA 285 in assemblies shown.
 - 05 Minimum thickness: 1-1/2"
 - 06 Aged thermal resistance: R-5.0 per inch minimum.
 - 07 Flame Spread: Class A flame spread, <25 ASTM E84.

- 1 08 Smoke Development: <450 ASTM E84.
2 09 Size at light gauge steel framed back-up walls: 4' x 8' sheet size.
3 Minimize joints as much as practical.
4 10 CMU back-up walls: Width to fit between vertical spacing of masonry
5 reinforcement.
6
7 G. Masonry / Stone Veneers: Design of continuous rigid insulation is based on Atlas
8 Roofing Energy Shield CGF Rigid Insulation.
9 01 This product shall be used behind all masonry / stone veneer walls.
10 02 Closed cell, polyisocyanurate (polyiso) foam core faced with a reflective
11 12 mil reinforced foil facers on one side and a white 12 mil reinforced
12 acrylic-coated aluminum facer on the other.
13 03 Classified Type X in accordance with ASTM C578.
14 04 Certified to comply with NFPA 285 in assemblies shown.
15 05 Minimum thickness:
16 06 Aged thermal resistance: R-5.0 per inch minimum.
17 07 Flame Spread: Class A flame spread, <25 ASTM E84.
18 08 Smoke Development: <450 ASTM E84.
19 09 Water vapor transmission: 0.1 perm maximum.
20 10 Size at light gauge steel framed back-up walls: 4' x 8' sheet size.
21 Minimize joints as much as practical.
22 11 CMU back-up walls: Width to fit between vertical spacing of masonry
23 reinforcement.
24
25 H. Rigid Board Insulation Adhesive:
26 01 Provide manufacturer's recommended adhesive for substrate being
27 applied.
28 02 Verify compatibility with weather barrier materials.
29
30

31 PART 3 - EXECUTION

32 3.1 INSTALLATION

- 33
34
35 A. Batt or Roll Thermal Insulation:
36 01 Batts shall fit between studs and provide full coverage at exterior building
37 envelope.
38 02 Install in continuous lengths where ever possible.
39 03 Install adhesive-mounted spike devices with metal caps at 2'-0"
40 vertically, and 4 inches horizontally from each side of the blanket.
41 04 Install blankets with long dimensions running vertically on spikes,
42 keeping blankets tight to exterior wall without crushing.
43 05 On the exterior side of all structural steel located directly behind
44 sheathing.
45
46 B. Batt or Roll Acoustical Insulation:
47 01 Place acoustical insulation in partitions tight within spaces, around cut
48 openings, behind and around electrical and mechanical items within or
49 behind partitions and tight to items passing through partitions.
50 02 Install in continuous lengths where ever possible.
51 03 Install adhesive-mounted spike devices with metal caps at top of each
52 blanket, and 4 inches horizontally from each side.
53 04 Suspend blankets 1" above finish floor.
54
55 C. Rigid Board Insulation:

- 01 Install board insulation at exterior masonry walls between masonry reinforcement in accordance with manufacturer's printed instructions. Do not bend or alter masonry ties to secure rigid insulation in place.
- 02 Install board insulation on dampproofed sheathing at all light gauge steel framed walls.
- 03 Secure insulation boards to back up surface with manufacturer's recommended adhesive that is compatible with weather barrier product.
- 04 Install with joints tight to provide full coverage.
- 05 Cope / cut insulation to fit irregularities, masonry ties and obstructions as required to achieve full coverage.
- 06 Take precautions to assure that insulation board is concealed within cavity wall construction.

3.2 PROTECTION

- A. Upon completion of batt insulation, use all means necessary to protect material from becoming wet.
 - 01 In the event batt or acoustical insulation comes in direct contact with moisture or becomes wet, remove and discard, and replace insulation with dry material.
 - 02 In the event batt insulation becomes damp or moist, thoroughly dry insulation prior to covering up.
 - 03 Use all means necessary to assure that batt and acoustical insulation is completely dry at the time of cover-up and will not promote the growth of mold.
- B. Protect rigid insulation as required to prevent damage and delamination.

END OF SECTION

SECTION 07 56 16

FLUID APPLIED ROOFING (OVER PREFORMED METAL PANELS) (Alternate 1)

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- . Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- A. Scope of Work:
 - 01 Fluid applied flexible acrylic waterproofing system over preformed metal building panels.
 - 02 Preparation of the roof deck.
 - 03 Penetration flashings.
 - 04 Metal Flashings, including gutters and downspouts.
 - 05 The Contractor shall review all Sections of these Specifications to determine items of work that will interface with the application of this roofing system. Coordination and execution of related Sections shall be the responsibility of the Contractor.
- C. Related Work:
 - 01 Section 07 62 00 – Sheet Metal Flashing
 - 02 Section 07 62 23 – Thru-Wall Flashing.
 - 03 Section 07 72 00 – Roof Accessories
 - 04 Section 07 72 23 – Roof Hatches and Vents
- D. System Description:
 - 01 The fluid applied roofing system must consist of a reinforced elastomeric system specifically designed for use on a roof. The system must have been approved by FMRC (Factory Mutual Research Corporation) according to Standard 4470 for Class 1 Roof Constructions which includes- Spread of Flame Fire, Windstorm Pressure, Windstorm Pull, Hail Damage, Resistance to Foot Traffic, and Susceptibility to Leakage Classifications.

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Manufacturer's specifications, test reports and other data for all products proposed to be furnished as needed to prove compliance with specified requirements.
- C. Manufacturer's complete installation instructions for system(s) proposed to be provided.
- D. Shop Drawings: Complete Shop Drawings by manufacturer indicating:
 - 01 Layout of joint reinforcing.

- 02 Details at all flashing and penetration conditions. Details shall be specific to this project including correct substrates and interfacing work.
- E. Manufacturer's complete installation instructions.
- F. Manufacturer's recommended and standard maintenance procedures for the products / system being installed.
- G. Written certification from the roofing system manufacturer corporate officer certifying that the applicator is currently approved for installation of the specified roofing system; and is a tier 1 / highest quality manufacturer's applicator.
- H. Samples:
 - 01 Provide samples of metal flashing(s) proposed to be furnished. Samples shall be a minimum length of 6".
 - 02 Provide a full range of color samples for prefinished metal flashing for selection by the Architect. Samples shall be on metal material.
- I. Manufacturer's field representative observation reports during the construction phase.
- J. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.
- K. Operations and Maintenance Manuals:
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to Section 01 78 23 – Operations and Maintenance Manuals.
 - 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 01 ASTM B117 - Test Method of Salt Spray (Fog) Testing.
 - 02 ASTM G29 - Test Methods for Algae Resistance.
 - 03 ASTM E108 - Test Method for Fire Test of Roof Coverings.
 - 04 ASTM D1653 - Water Vapor Transmission of Materials.
 - 05 ASTM G26 - Practice for Operating Light- and Water-Exposure Apparatus (Xenon Arc Type) for Exposure of Nonmetallic Materials.
 - 06 ASTM D412 - Ultimate Tensile Strength at Break.
 - 07 ASTM D6083 - Standard Specification for Liquid Applied Acrylic Coatings used in roofing.
 - 08 ASTM C1549 - Standard test method for determination of solar reflectance near ambient temperature using a portable solar reflectometer.
 - 09 ASTM C1371 - Standard test method for determination of emittance of materials near room temperature using portable emissometers.
 - 10 FM 4470- Standard for Class 1 Spread of Flame Fire, Windstorm Pressure, Windstorm Pull, Hail Damage, Resistance to Foot Traffic, and Susceptibility to Leakage Classifications.

1.4 QUALIFICATIONS

- A. Manufacturer's Qualifications: Manufacturer shall demonstrate twenty (20) years of experience in fluid applied roofing.
- B. Applicator Qualifications:

- 01 The applicator of the roofing material specified herein shall be a tier 1 / highest quality rated approved applicator.
- 02 Applicator shall have a minimum of five (5) years of experience in the application of fluid applied roofing.

1.5 QUALITY CONTROL

- A. Codes and Standards: The Contractor shall make himself thoroughly familiar with all codes, regulations, and standards governing the specified Work. Any contradiction between the manufacturer's requirements and these Specifications shall be brought to the attention of the Architect and shall be fully resolved prior to proceeding with installation.
- B. Deviations: There shall not be any deviations from these Specifications unless the deviation is submitted in writing to the Architect. The request for deviation must have a letter from the roofing manufacturer's technical department approving the details of the deviation.
- C. An Approved Applicator shall be on site during all applications of any Fluid Applied Roofing.
- D. Roofing manufacturer's agent must approve substrate prior to commencement of roofing application.
- E. The wet film thickness shall be measured and recorded daily, along with the quantity, batch numbers and total square feet applied on the Daily Quality Control Report.
- F. Manufacturer's Technical Representative: An authorized agent of the roofing manufacturer shall be on site at least once every seven (7) calendar days during the Work specified herein.
 - 01 The technical representative shall provide a written inspection report, during each site visit and submit the reports to the Architect.
 - 02 The manufacturer's representative must approve the application process at specific stages before the Contractor may continue including: trade start-up meeting, at the completion of the foundation coats, reinforcing fabric components, and completed finish coats installation.

1.6 MANUFACTURER'S FIELD REPRESENTATION

- A. Manufacturer's Field Representative: An authorized, technical agent of the roofing manufacturer shall be assigned to the project to conduct field observations during the installation phase.
 - 01 In as much as possible, the originally assigned field representative shall remain consistent for all site visits and observations.
- B. Regularly scheduled, on site observations shall be required by the manufacturer's field representative a maximum of every fourth working day during the roofing installation period; exceptions being made for inclement weather, holidays, etc.
 - 01 Manufacturer's representative shall notify the Contractor and Architect's Field Representative of scheduled site visits a minimum of 24 hours in advance.
- C. Observation reports shall include the following:
 - 01 Written report / documentation of the installation progress at the time of the site visit.
 - 02 The report shall include documentation of any issues / questions and how the issue(s) were resolved.

- 03 The report shall include record of directives given to the Roofing Contractor.
 - 04 Digital photographic documentation of the roofing progress; including documentation of specific issues and areas / details in question.
 - 05 Each report shall contain project name, IBI Group project number, date / time / duration of site visit.
- D. In addition to the progress observations, the manufacturer's representative must:
- 01 Attend the roofing trade start-up meeting.
 - 02 Approve the application of the foundation coats.
 - 03 Approve the application of reinforcing fabric components.
 - 04 Approve the application of completed finish coats.
- E. All observation reports shall be kept current and shall be delivered electronically to the Contractor and Architect within five (5) calendar days after the observation. Progress payments for roofing work may be withheld if observation report submissions are not current.
- F. After completion of all roofing work, and prior to acceptance of the roofing installation, manufacturer's representative shall conduct an observation to document all roofing work to be corrected as a condition of acceptance.
- 01 Each item requiring corrective work shall be identified (including specific location) and required corrective action shall be noted.
 - 02 The final observation report must be produced in writing with photographic back-up. Marking corrective items on the roof alone shall not be acceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

- G. Deliver materials to site in manufacturer's unopened and undamaged containers bearing the following information:
- 01 Name of manufacturer.
 - 02 Name of contents and products code.
 - 03 Net volume of contents.
 - 04 Lot or batch number.
 - 05 VOC content.
 - 06 Storage temperature limits.
 - 07 Shelf life expiration date.
 - 08 Mixing instructions and proportions of contents.
 - 09 Safety information and instructions.
- H. Store and protect materials from damage and weather in accordance with manufacturer's instructions.
- I. Store materials at temperatures between 50°F to 90°F (10.0°C to 32.2°C). Keep out of direct sunlight.
- J. Support stored material containers on pallets and cover with tarpaulin tied to bottom of pallets.

1.8 WARRANTY

- A. Upon completion of installation, and as a condition of acceptance by the Owner and Architect, the roofing manufacturer shall supply to the Owner a Fifteen (15) Twenty (20) Year, No-Dollar-Limit, non-prorated warranty, signed by a corporate officer of the corporation that includes the complete assembly, base flashings and other assemblies covered by this Section.

- B. The roofing systems manufacturer shall provide an annual inspection of the roof for the life of the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. These specifications are based on the products, components and assemblies of the "Premium Coat System", as manufactured by Hydro-Stop, Quest Construction Products.
- 01 Terminology used in this specification includes direct reference to Hydro-Stop products and shall establish the minimum properties, characteristics and performance criteria for other listed acceptable manufacturers.

2.2 MEMBRANE COMPOUND MATERIAL

- A. Waterproofing Material: PremiumCoat three-stage, fabric reinforced, flexible acrylic coating, fluid applied in successive stages to form one continuous, seamless, watertight membrane; 40 mil minimum cured total system thickness; comprised of the following:
- 01 Foundation and Saturation Coats: PremiumCoat FoundationCoat (highly flexible water based 100% pure acrylic polymer resin coatings).
- 02 Fabric: Hydro-Stop polyester, non-woven, stitch-bonded, and heat-set fabric.
- 03 Finish Coat: PremiumCoat FinishCoat (ultraviolet light resistant, blend of highly flexible water based 100% pure acrylic polymer resin coating); color as selected from manufacturer's standard colors.

- B. Reinforcing Fabric: This material shall be non-woven 100% polyester, stitch bonded, heat set fabric with the following characteristics:

01	Weight:	3 oz / per square yard	
02	Tensile Strength:	Warp 74 lbs. (33.60 kg)	per ASTM D 5034
		Fill 45 lbs. (20.43 kg)	
03	Elongation @ Break:	Warp 21.3%	per ASTM D 5034
		Fill 51.3%	
04	Ball Burst:	111 lbs. (50.39 kg)	per ASTM D 3787
05	Trapezoid:	Warp 13.5 lbs. (6.13 kg)	per ASTM D 117
		Fill 24.2 lbs. (10.99 kg)	
06	Thickness:	.018 inches (.457 mm)	per ASTM D-1777

- C. Cured Membrane Characteristics:

	PROPERTY	TEST	RESULT
01	Elongation	ASTM D638	>300% elastomeric
02	Tensile Strength (cured)	ASTM D412	>2000 PSI (13,789 kPa)
03	Density:		12.1 lb/gal
04	Volume Solids:		> or = 53 %
05	Weight Solids:		> or = 66%
06	Algae Resistance	ASTM G29	No Growth Supported
07	Moisture Vapor	ASTM E96	3 Perms
08	Weathering	ASTM G26	No effect after 3,000 hours.
09	Salt Spray Test	ASTM B117	No effect.
10	Fire Rating	ASTM E108	Class A
11	VOC (calculated):		< 72 g/L
12	Susceptibility to Leakage	FM 4470	No signs of water leakage.
13	Windstorm Pressure	FM 4470	Meets Class 1- 90
14	Windstorm Pull	FM 4470 Class 1-375	on Lightweight Concrete
15	Severe Hail Test	FM 4470	No separation or rupture 1-SH

16	Resistance to Foot Traffic	FM 4470	No sign of tearing or cracking.
17	Liquid Applied Acrylic	ASTM D6083	Approved
18	Solar Reflectance	ASTM C1549	> or = 0.90
19	Thermal Emittance	ASTM C1371	> or = 0.79
20	OTC (Ozone Transport Commission)		Compliant
21	California Title 24		Compliant
22	CRRC (Cool Roof Rating Council)		Approved
23	Energy Star (Dept. of Energy)		Approved
<i>(White or Cotton Finish Coat Only)</i>			

2.3 ACCESSORIES

- A. Cant Strips: Recommended composition materials are EPS (Expanded Polystyrene), ISO (Polyisocyanurate), and wood (non-treated). Cant strips are to be installed at all internal corners, around curbs, and at all vertical 90 degree angles specified by Hydro-Stop.
- B. Hydro-Fiber: Bulking material used in conjunction with Foundation Coat or BarrierGuard slurry (as specified by Hydro-Stop Technical Representative) to fill cracks, voids, or low depressions on various substrates.
- C. StableRust Primer: Water-based surfactant-free primer used in direct metal applications to stabilize and protect metal surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate surfaces are durable, free of frozen matter, dampness, loose particles, cracks, pits, projections, or foreign matter detrimental to adhesion or application of waterproofing system.
- B. Verify that substrate surfaces are smooth and not detrimental to full contact bond of waterproofing materials.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.
- D. Verify that substrate areas are adequately supported and firmly fastened in place.
- E. Verify that the concrete deck has a minimum slope of .25 inch / foot (2.083cm/meter).
- F. Verify that roof does not have ponding water areas.
- G. Verify that all attached vertical walls are properly waterproofed.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. As a minimum, clean and prepare surfaces to receive waterproofing by removing all loose and flaking particles, grease and laitance with the use of a stiff bristle push broom and or washing.
 - 01 Care should be taken not to inject water into the substrate during washing. In some cases, additional drying time may be required after the cleaning process.

Please consult manufacturer's representative for additional advice on cleaning various roofing substrates.

- C. Make all necessary repairs to existing substrate as required by the roofing manufacturer.
- D. Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer.

3.3 APPLICATION

- A. Bare Metal or Clean Rusted Metal: Remove all scale and apply StableRust Primer at a rate of 200 sqft/ gal (4.755 sqm/ liter) to all rusted areas. Allow to dry. Protect from weather until dry.
- B. Foundation Coat & Fabric Components- Consist of one coat of FoundationCoat applied to the substrate, Hydro-Stop PremiumCoat Fabric (sizes vary) laid into the wet FoundationCoat, and finally a second coat of FoundationCoat saturating the fabric from above.
 - 01 Care should be given to ensure that adjacent runs of fabric are overlapped a minimum of 4 inches.
 - 02 Foundation Coats are applied at a total rate of 40 SF/gal.
 - 03 FoundationCoat should only be applied with the use of approved roof brushes. Rolling, and spraying of the FoundationCoat are absolutely forbidden.
 - 04 Roof Penetrations- Using 12-inch fabric and the Foundation components (described above) seal items projecting through waterproofing material watertight. Waterproof up penetrations a minimum of 6".
 - 05 Vertical Seams- Using 6-inch fabric and the Foundation components (described above) seal all vertical seams. Foundation Coat & Fabric components must be centered on the panel seams. Protect from weather until dry.
 - 06 Horizontal Laps- Using 12-inch fabric and the Foundation.
 - 07 components (described above) seal all horizontal laps. Foundation Coat & Fabric components must be centered on the panel laps. Protect from weather until dry.
 - 08 Exposed Mechanical Fasteners- Using either a Hydro-Cap or a 6 in. x 6 in. piece of fabric and the Foundation components (described above) seal all mechanical fasteners. Protect from weather until dry.
 - 09 Parapet & Vertical Wall Junctions- Using 12-inch fabric and the Foundation components (described above), waterproof roof/wall junctions. Continue waterproofing up vertical surfaces and onto deck a minimum of 6 inches in each direction.
 - 10 Finish Coat Component- Apply 2 coats of FinishCoat at a combined total rate of 70 sqft/gal over entire roof area. Minimum millage requirements are 11.5 mils wet and 6.1 mils dry per coat.
 - 11 Allow to dry between coats. Total Finish Coat dry thickness should be a minimum of 12.2 mils (.0122 inches / .31 millimeters).
 - 12 Completed PremiumCoat System- System must be installed to a minimum 40 mil total cured thickness over all seams, laps, fasteners, wall junctions, and penetrations.
 - 13 Non-fabric areas of the roof must have a minimum of 15 mils total cured thickness.

3.4 PROTECTION OF FINISHED WORK

- A. Monitor finished system for a minimum of seven (7) days, sweeping off birdbaths to allow for full cure.
- B. Provide necessary means to protect roof from damage by other trades / traffic on the roof.
- C. In case of damage, immediately notify the roofing manufacturer and repair roof as directed.

3.5 CLEANING

- A. Immediately clean unscheduled surfaces receiving waterproofing in accordance with manufacturer's instructions.

END OF SECTION

SECTION 07 62 13

SHEET METAL FLASHING (PRE-FINISHED)

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all sheetmetal flashing and metal thru-wall flashing as indicated on the Drawings and required for a complete installation.
- C. Related Work:
 - 01 Section 07 41 13 – Metal Roof Panels
 - 02 Section 07 72 00 – Roof Accessories
 - 03 Section 13 34 19 – Metal Building Systems
 - 04 All sections of Work relating to or affecting the roof system, including mechanical, plumbing and electrical items.
- D. Include all shop and field formed sheet metal work shown on Drawings, specified or required, including, but not limited to:
 - 01 Roof penetration sleeves, hood and umbrella counterflashing.
 - 02 Metal counterflashing and thru-wall flashing.
 - 03 Expansion joints.
 - 04 Scuppers.
 - 05 Metal perimeter roof edge flashing.
 - 06 Gutters, downspouts, and splash pans.
 - 07 One-way roof moisture relief vents.
 - 08 Metal gravity vents.
 - 09 Copings, trim and miscellaneous sheet metal flashing and accessories.
- E. All Work shall be coordinated with the specified roofing system in accordance with roofing system manufacturer's standards and requirements.
 - 01 Where applicable, sheet metal flashing shall be included as a component of the roofing system warranty.
 - 02 Coordinate as required.

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.

- 02 Show details of shop fabrications, connections and details.
- 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 01 ASTM A653/A653M-06 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 02 ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - 03 ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 04 ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 05 ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
 - 06 ASTM E646 Standard Test Method for Tensile Strain-Hardening Exponents (n-Values) of Metallic Sheet Materials.
 - 07 ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 - 08 ASTM E1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
 - 09 ASTM E2140 Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.
- B. National Association of Architectural Metal Manufacturers (NAAMM).
- C. National Roofing Contractors Association (NRCA):
 - 01 Roofing and Waterproofing Manual.
- D. Sheet Metal and Air Conditioning Contractors National Associate, Inc. (SMACNA):
 - 01 Architectural Sheet Metal Manual.

1.4 QUALITY ASSURANCE

- E. Single source responsibility: Fabricator of roof-related flashing and accessories shall be from a single source supplier.
 - 01 Provide products from an acceptable manufacturers with a minimum of five (5) years of satisfactory experience in sheetmetal flashing fabrication.
- F. Sheet metal flashing that interfaces with the roofing system shall be installed by the roof

installer.

- 01 Coordinate as required for proper installation and interface in accordance with the roofing system manufacturer.
- 02 Coordinate all sheetmetal flashing associated with the specified roof system with the roof manufacturer and installer to assure compatibility.
- 03 Where roofing membrane or cap sheet is adhered to the sheetmetal flashing, provide primer, surfacing or other coating as required by the roofing manufacturer for proper interface and adherence to the roofing warranty requirements.

G. Comply with governing codes and regulation of authorities having jurisdiction.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, handle and store materials in accordance with manufacturer's instructions.
- B. Handle and store materials and equipment in such a manner to avoid damage.
 - 01 All damaged materials shall be removed from site and replaced with new fabrications.
- C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day.
 - 01 Any exception must be in written form.
 - 02 Do not place materials or equipment in such a manner as to overload structure.

1.6 WARRANTY

- A. Roofing Contractor's Warranty:
 - 01 Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
 - 02 Defects shall include, but not be limited to:
 - a. Leaking water or bitumen within building or construction.
 - b. Becoming loose from substrate.
 - c. Loose or missing parts.
 - d. Finish failure as defined above.
 - 03 Correction may include repair or replacement of failed products.
 - 04 Warranty shall state that defects of the sheet metal occurring during the warranty period that cause damage to the building interior or exterior shall be promptly addressed by the Contractor within a maximum of forty-eight (48) hours after notification.
- B. Manufacturer's Product Finish Warranty:
 - 01 Manufacturer's standard twenty (20) year Kynar 500 or Hylar 5000 Finish warranty signed by the manufacturer, guaranteeing covering failure of the fluoropolymer finish during the warranty period.
 - 02 Failure is defined to include, but not be limited to:
 - a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
 - 03 Correction shall include replacement of defective / failed products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers / fabricators providing sheetmetal flashing shall meet or exceed the following requirements:
 - 01 Their products meet or exceed the Specifications.
 - 02 Fabricator has a minimum of five (5) years of experience manufacturing products of the type specified.
 - 03 Products have been tested in conjunction with roofing system as an assembly and as such have obtained the same approval and rating as the roofing membrane system.
 - 04 Products are approved for use by the roofing system manufacturer.
- B. Manufacturers / fabricators shall coordinate with the roofing system manufacturer to assure compatibility and proper interface with the roofing system manufacturer's standards and requirements.

2.2 SHEET METAL MATERIALS

- A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing system as an assembly and have the same approval and rating as the roofing system.
- B. Flashing Stock Material: zinc-coated (galvanized) steel; commercial quality with 0.20 percent copper, G90 hot-dip galvanized ASTM A526, except ASTM A527 for lock-forming material.
 - 01 Cap flashing, roof edge, parapet, coping and miscellaneous flashing shall be minimum 24 gauge. Associated flashing clips / cleats shall be minimum 22 gauge.
 - 02 Collector heads, downspouts and boots shall be minimum 22 gauge.
 - 03 Thru-wall metal flashing components shall be minimum 22 gauge.
- C. Finish: Finish for all exposed sheetmetal work shall be a premium, factory applied / baked on PVDF paint finish using a Kynar 500 resin base, containing a minimum of 70% fluoropolymer, meeting AAMA 2605-98 standards.
 - 01 BASF "Fluoroceram".
 - 02 PPG Industries "Duranar".
 - 03 The Velspar Corporation "Fluopon".
 - 04 Color on finish side shall be as selected by the Architect from the manufacturer's standard and custom / premium colors. Color on concealed side shall be manufacturer's option.
 - 05 Provide a strippable, protective coating material on all finished portions of pre-finished flashing; to be removed following installation.
- D. Finished Sheetmetal Locations: Provide pre-finished sheetmetal at all flashing locations exposed to normal view(s), including continuation of component to non-exposed locations. Typical locations include, but are not limited to:
 - 01 Roof edge / parapet / cap flashing.
 - 02 Gutters, scuppers, collector heads and downspouts.
 - 03 Masonry step flashing.
 - 04 Fascias and associated trim.
 - 05 Drip edges.
 - 06 Finish of fasteners for all pre-finished sheetmetal shall match the finish of the associated component.
- E. Unfinished Sheetmetal Locations: Provide unfinished, galvanized sheetmetal as described above at all flashing locations concealed from normal view(s). Typical locations include, but are not limited to:

- 01 Thru-wall flashing.
- 02 Pitch pans.
- 03 Roof curbs / hoods and associated flashing.
- 04 Roof-top equipment supports

2.3 FASTENERS

- A. Fasteners shall be same metal as flashing/sheet metal, or other non-corrosive metal as recommended by sheet manufacturer for the specific application. Match finish of exposed heads with material being fastened.
- B. Exposed fasteners shall be self-sealing and gasketed for weather tight installation. (ZAC type).
- C. Match finish of exposed heads with material being fastened.
- D. Mechanical fasteners:
 - 01 Nails: ring-shank, minimum 1-1/2 inches in length with ½ inch diameter head.
 - 02 Washers: steel washers with bonded rubber sealing gasket.
 - 03 Screws: self-tapping sheet metal type of stainless steel or compatible with material being fastened, with integral EPDM washers.
 - 04 Rivets: stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.
- E. Clips: Clips should be minimum 20 gauge stainless steel.

2.4 RELATED MATERIALS

- A. Solder: ASTM B32, flux type and alloy composition as required and recommended by the manufacturer for the metals to be soldered.
- B. Flux:
 - 01 Phosphoric acid type, manufacturer's standard.
 - 02 For use with stainless steel: acid-chloride type flux, except use rosin flux over tinned surfaces.
- C. Adhesives: type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and water tightness.
- D. Metal Accessories: sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of Work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.
- E. Sealant:
 - 01 Type A:
 - a. Type: one-part, non-sag, moisture-curing polyurethane sealant.
 - b. Approved Products/Manufacturers: "Chem-Calk 900" manufactured by Bostik Construction Products Division, "Vulkem 921" manufactured by Mameco International, Inc., "Dynatrol 1" manufactured by Pecora Corporation, "NP 1" manufactured by Sonneborn Building Products, or approved equal.
 - 02 Type B:
 - a. Type: one-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
 - b. Approved Products/Manufacturers: "Chem-Calk 1200" manufactured

by Bostik Construction Products Division, "795 Silicone Building Sealant" manufactured by Dow Corning Corporation, "895 Silicone" manufactured by Pecora Corporation, "Omniseal" manufactured by Sonneborn Building Products, "Spectrem 2" manufactured by Tremco Incorporated, or approved equal.

- F. Pitch Pan Filler:
 - 01 Type: pourable polyurethane sealer, approved by roofing system manufacturer.
 - 02 Approved Products/Manufacturers: "Quick Pitch Sealer" manufactured by U. S. Intec, "SPM Pourable Sealer" manufactured by Johns Manville, or approved equal.
- G. Termination Bar:
 - 01 Material: extruded aluminum bar with flat profile.
 - 02 Size: 1/8 inch thick by one (1) inch wide with factory punched 1/4" x 3/8" oval holes spaced six (6) inches on center.
 - 03 Approved Products/Manufacturers: "TB 125" manufactured by TruFast Corp. or approved equal.
- H. Pipe Hangers and Supports: Refer to Section 07721 – Roof Accessories.
- I. Splash Pans: 22-gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges onto lower roof.

2.5 FINISHES

- A. Finish: Finish for all exposed sheetmetal work shall be a premium, factory applied / baked on PVDF paint finish using a Kynar 500 resin base, containing a minimum of 70% fluoropolymer, meeting AAMA 2605-98 standards.
 - 01 BASF "Fluoroceram".
 - 02 PPG Industries "Duranar".
 - 03 The Velspar Corporation "Fluopon".
 - 04 Color on finish side shall be as selected by the Architect from the manufacturer's standard and custom / premium colors. Color on concealed side shall be manufacturer's option.
 - 05 Provide a strippable, protective coating material on all finished portions of pre-finished flashing; to be removed following installation.
- B. Finished Sheetmetal Locations: Provide pre-finished sheetmetal at all flashing locations exposed to normal view(s), including continuation of component to non-exposed locations. Typical locations include, but are not limited to:
 - 01 Roof edge / parapet / cap flashing.
 - 02 Gutters, scuppers, collector heads and downspouts.
 - 03 Masonry step flashing.
 - 04 Fascias and associated trim.
 - 05 Drip edges.
 - 06 Finish of fasteners for all pre-finished sheetmetal shall match the finish of the associated component.
- C. Unfinished Sheetmetal Locations: Provide unfinished, galvanized sheetmetal as described above at all flashing locations concealed from normal view(s). Typical locations include, but are not limited to:
 - 01 Thru-wall flashing.
 - 02 Pitch pans.
 - 03 Roof curbs / hoods and associated flashing.
 - 04 Roof-top equipment supports

2.6 FABRICATION

- A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counter flashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.
- B. Comply with manufacturer's installation instructions and recommendations.
- C. Shop fabricate Work to greatest extent possible. Fabricate inside and outside corners for metal edges, counterflashing, and coping caps.
- D. Fabricate items to size and dimensions as indicated on the Drawings. Limit single-piece lengths to ten (10) feet.
- E. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage or deterioration of the Work.
- F. Integrate flashing in a manner consistent with detailing. Form Work to fit substrates.
- G. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling of fullness in metal after installation.
- H. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling and oil canning.
- I. Fold back edges on concealed side of exposed edge to form hem.
- J. Unless noted otherwise, lap joints minimum one (1) inch. Rivet and solder joints on parts that are to be permanently and rigidly assembled.
- K. Seams:
 - 01 Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
 - 02 Pre-finished metal: seal pre-finished metal seams with rivets and silicone sealant.
 - 03 Metal other than aluminum: tin edges to be seamed, form seams, and solder.
- L. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand flanges prior to applying any primers. Prime all metal in contact with bituminous material.
- M. Back paint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metal.
- N. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.

2.7 FABRICATED ITEMS

- A. Metal Flashings:
 - 01 Through wall receiver tray: minimum 24 gauge stainless steel. Fabricate receiver tray to full depth of wall cavity, solder all joint and end dams.

- 02 Counterflashing: minimum 24-gauge stainless steel, unless otherwise shown on Drawings.
- B. Wind Clips: Minimum 24-gauge stainless steel (or match material of counterflashing), one (1) inch wide by length to engage counterflashing a minimum of ½ inch.
- C. Roof Penetrations:
 - 01 Umbrella counterflashing: two-piece construction of minimum 22-gauge stainless steel, fabricated in accordance with Drawings or project requirements.
 - 02 Flashing pans:
 - a. 24 gauge stainless steel.
 - b. Fabricate to provide installed minimum clear inside perimeter dimension of two inches on each side of penetration element.
 - c. Fabricate pans to at least six inches above the finished roof membrane and with ¼ inch hem at tope edge and with four inch flanges. Round all corners of flange.
 - d. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from ¼ inch steel plate. Draw band bonnets fabricated from 22 gauge stainless steel may be used on circular projections.
- D. Metal Edge:
 - 01 Minimum 24 gauge stainless steel formed in maximum ten foot lengths, with six inch wide cover plates of same profile, four inch flange.
 - 02 Provide expansion slip joints a maximum 20 feet on center.
 - 03 Shop fabricate all interior and exterior corners. Fabricate exterior corners with 18 inch minimum to four foot maximum legs. Lap, rivet, and seal prior to delivery to jobsite.
 - 04 Fabricate to sizes and dimensions as indicated on drawings with a minimum one inch coverage past top of wall. Refer to SMACNA Fig. 2-5A.
 - 05 Provide mock-up for Architect's approval prior to fabrication.
- E. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24-gauge stainless steel, or as shown or directed otherwise.
- F. Coping:
 - 01 24 gauge stainless steel, with 6" wide cover plates of same profile.
 - 02 Fabricate as outlined in SMACNA; refer to Figure 3-4A.
 - 03 Provide tapered substrate to slope to one side and cover with waterproof membrane.
 - 04 Install with continuous cleat on side and fasten other side.
- G. Pipe Box Cover: 24 gauge stainless steel.
- H. Heat Exhaust Curbs and Hoods: 22 gauge stainless steel.
- I. Expansion joint cover: Minimum 24 gauge stainless steel. Provide pre-finished aluminum metal at perimeter edge and termination.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

- B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.
- C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.
- D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

- A. Field measure site conditions prior to fabrication work.
- B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

- A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form ¼" hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or place and at intersections. Locate field joints not less than 12" nor more than 3' from actual corner. Laps shall be 1", riveted and soldered at following locations:
 - 01 Pre-fabricated corners.
 - 02 Transitions.
 - 03 Changes in direction, elevation, and plan.
 - 04 At intersections.
- B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible, and set units true to line and level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.
- C. Install fabricated sheet metal items in accordance with manufacturer's installation instruction and recommendations and with SMACNA Architectural Sheet Metal Manual.
- D. Separations: provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation locations of contact as recommended by manufacturer of fabricator. Do not use materials which are incompatible with roofing system.
- E. Continuous cleat: at exposed edges of perimeter edge, fascias, cap flashings, and where required, attaché continuous cleat at 6" on center with appropriate fastener.
- F. Gravel guard/fascia:
 - 01 Install with expansion joints 10' on center, ½" expansion leeway, with cover plate.
 - 02 Set in asphalt mastic and fasten into nailer at 3" on center, staggered.
 - 03 Buff sand Kynar surface of flange and prime.
 - 04 Strip in flange with specified stripping plies in hot bitumen extending 6" from the outer edge of the flange and butt base of gravel stop.
- G. Counterflashing:
 - 01 Do not use surface mount counterflashing.
 - 02 Set in through wall with receiver and spring lock counterflashing, as detailed in Drawings and to NRCA roofing manual, SMACNA standards.

- 03 Coordinate installation of through wall flashing with the masonry contractor.
 - 04 Seal through wall in conjunction with masonry wall waterproofing.
 - 05 Install wind clips 30" on center at all counterflashing over 5' in length.
- H. Pitch Pans:
- 01 Apply mastic under pitch pan flange at least ½ pound per linear foot.
 - 02 Prime all metal flanges with asphalt primer prior to flashing installation.
 - 03 Clean all projection enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.
 - 04 Fill base of pitch pans with grout or cementitious binder and allow to cure.
 - 05 Top finish fill: self-leveling, one part urethane, at least 2" to top of pitch pan sides.
 - 06 Strip in flange with specified stripping plies in hot bitumen extending 6" from the outer edge of the flange and butt base of pitch pan.
- I. Roof Drains:
- 01 After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
 - 02 Extend lead flashing into drain bowl or pipe a minimum of 2" and over top of piping/bowl connections, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
 - 03 If drain bowl and pipe connection is contaminated with bituminous materials, strip-in area with 3 coursing of plastic roof cement and fabric.
 - 04 Prime top of lead flashing sheet to receive strip-in membrane.
- J. Pipe Box:
- 01 Fully solder joints and connections.
 - 02 Height shall be 6" minimum above roof surface.
 - 03 Install with flanges set in plastic roof cement on roof membrane.
 - 04 Fill pans with grout to a height of ¾" of the total pan height.
 - 05 Fill remaining height of pitch pans with specified pitch pan filler.
 - 06 Install hood over pan securing to each side with self-tapping screws.
 - 07 Install face plate to cover box opening around pipe penetrations.
- K. Sanitary Vent Stacks:
- 01 Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
 - 02 Fold lead sleeve down inside of pipe a minimum of 1". Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.
- L. Expansion Joint:
- 01 Construct wood curbs as shown on drawings using materials specified in Section 07 52 00 – Modified Bituminous Membrane Roofing or if not specified there, use materials specified in Section 06 10 00– Rough Carpentry.
 - 02 Install underlayment, form envelope, and secure underlayment to curb. Fill envelope with compressible insulation.
 - 03 Securely fasten expansion joint cover to curb with grommet type fasteners spaced 6" on center.
 - 04 Taper expansion joint down at the metal edge.
 - 05 Shall be installed as detailed on drawings and as outlined in the NRCA Roofing Manual and SMACNA.
- M. Coping:
- 01 Install wood nailers as shown on Drawings.

- 02 Install metal cleats with appropriate fasteners spaced 6" on center.
- 03 Install underlayment over the wood substrate. Lap ends minimum of 6" and secure membrane in place. Seal laps with appropriate adhesive.
- 04 Install metal coping allowing 1/2" spaces between segments.
- 05 Lock coping onto cleat and install appropriate fasteners through the interior fascia space 24" on center in enlarged holes.
- 06 Install appropriate fastener through neoprene washer and cover plate between coping segments.
- 07 Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joints a minimum of 4". Fasten cover plate on one side of joint only. Provide wall flashing membrane up and over parapet wall in accordance with manufacturer's detail.

3.4 CLEANING AND PROTECTION

- A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.
- B. Remove scraps and debris and leave work area clean.
- C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.
- D. Prime soldered area of phosphitized metal after cleaning to prevent rusting.
- E. Paint metal flashings that have been soiled with bitumen with aluminized paint.
- F. Clean other Work damaged or soiled by Work of this Section.
- G. Protect finished Work from damage.

END OF SECTION

SECTION 07 65 26

SELF-ADHERING SHEET FLASHING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide self-adhering sheet flashing at exterior walls to transition from one assembly to another as required to provide a continuous, sealed building envelope.
 - 02 Locations include, but are not limited to:
 - a. Masonry / brick ledges.
 - b. All openings through exterior walls.
 - c. Wall to roof transition.
 - d. As indicated on the Drawings.
- A. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 06 10 00 – Rough Carpentry
 - 03 Section 07 53 60 - Modified Bituminous Membrane Roofing
 - 04 Section 07 62 00 – Sheet Metal Flashing
 - 05 Section 08 80 00 – Glazing
 - 06 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

- A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.

- 02 Where applicable, provide recommended maintenance schedules and procedures.
- E. Sample Panel: Sample panel shall be 8' long x 6' high panel showing completed through-wall flashing at first course of masonry and dampproofing assembly, complete with exterior sheathing, rigid insulation (where applicable). Coordinate as required with other trades.
 - 01 Panel shall be "L" shaped (4' x 4') with metal stud / drywall back-up wall on one side and CMU back-up on one side.
 - 02 Once accepted by the Architect, the sample panel shall be the standard by which installed is judged.
 - 03 Sample panel shall remain at the jobsite until all through-wall flashing and dampproofing is completed.
- F. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 WARRANTY

- A. Provide a material and labor, non-prorated, manufacturer / installer minimum two (2) year warranty that material will remain free of defects and installation shall remain water tight.
 - 01 Defects shall include, but not be limited to delamination, slippage on substrate and / or deterioration of sheet.

PART 2 - PRODUCTS

2.1 SELF ADHERING SHEET FLASHING MANUFACTURERS

- A. Design of self-adhering sheet flashing is based on products manufactured by Henry Company.
- B. Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section, provided proposed products meet or exceed all specified requirements:
 - 01 Grace Construction Products
 - 02 Polyguard Products, Inc.
 - 03 Tremco
- C. Provide primers, glass fabric scrim tape, mastic and other materials not specifically described, as required for a complete and proper installation as recommended by the manufacturer.

2.2 SELF ADHERING SHEET FLASHING

- A. By definition for Work covered by this Section, "self-adhering sheet flashing" shall refer to all flexible flashing installed at both through-wall and non-through-wall conditions.
 - 01 Metallic thru-wall flashing shall be as specified in Section 07 62 00 – Sheet Metal Flashing.
- B. Flexible, Self-Sealing Wall Flashing:
 - 01 Design of self-adhering sheet flashing is based on Henry Company Blueskin TWF Self-Adhesive Thru-Wall Flashing Membrane.

- 02 Description: Self-adhering, membrane consisting of an SBS rubberized asphalt compound which is integrally laminated to a cross laminated polyethylene (HDPE) film, with a silicone release sheet, specifically designed for thru-wall flashing conditions.
 - 03 Width: Select either 12 inch, 18 inch, 24 inch, 36 inch wide rolls.
 - 04 Thickness: 40 mils. Film thickness: 9 mils.
 - 05 Elongation: 200% minimum (ASTM D412 Die C).
 - 06 Water vapor transmission: 0.03 perms (ASTM E96 Method B).
 - 07 Membrane tensile strength: 800 psi minimum.
- C. Primers and Sealants:
- 01 Provide primers as recommended by the manufacturer for the specific substrate, condition and assembly.
 - 02 Provide sealants as recommended by the manufacturer for the specific substrate, condition and assembly.
- D. Termination Bar:
- 01 1" x 1/8" aluminum or stainless steel flat bar.
 - 02 Pre-drilled to fasten at maximum 16" O.C.
 - 03 Fasteners shall be cadmium plated or stainless steel, self-tapping screws.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Working Conditions: Apply under normal working conditions above 45°F and rising. Do not apply when rain is imminent.
- B. Storage: Keep container tightly sealed and protect from freezing in shipping and storage.
- C. Surface Preparation:
 - 01 All dust, dirt, old loose or scaling coatings shall be removed from the surface before coating or application of thru-wall flashing.
 - 02 All brick ledge conditions shall be free of dirt and dust prior to application of thru-wall flashing.
 - 03 All cracks, joints, penetrations, and splits should be sealed, repaired with 4 inch wide glass fabric scrim tape embedded in Henry Company #789.
 - 04 Dusty or porous masonry surfaces should be dampened with water. Highly porous masonry should be primed with Henry Company #788 Asphalt Primer or #351 Non-fibered Emulsions which has been thinned with 1 gallon water per 5 gallons of #788.
 - 05 Metal surfaces shall be free of rust, cleaned and primed.
 - 06 Architect shall approve the taping of joints and surface preparation prior to the application of the dampproofing.

3.2 LOCATIONS

- A. Self-Adhering Sheet Flashing:
 - 01 All foundation masonry / brick ledges. At locations where adjacent concrete flatwork is above the bottom of the brick ledge, two (2) layers shall be applied – one at base of brick ledge and one at the first brick course above the adjacent flatwork.

- 02 Over heads of openings on steel lintel angles back to wall sheathing / substrate.
 - 03 Under sills and at jambs of openings (not thru wall). Install additional thru-wall flashing at window jambs to lap over the end dams of all sub-sill flashing. Coordinate with window installer as required.
 - 04 At perimeter of building at roof lines and parapets (not thru wall) extending down onto exterior walls (sheathing or CMU as applicable).
 - 05 At all exterior wall conditions as required to divert moisture within wall cavities to the building exterior.
 - 06 At all openings through exterior sheathing / CMU resulting from structural steel or other interfacing work.
 - 07 Bridging building expansion joints that telegraph into exterior back-up wall substrate.
 - 08 Where indicated on Drawings.
- B. Termination Bar: Continuous at the top edge of the vertical surface of all thru-wall flashing at all masonry ledges, wall-to-roof masonry conditions and masonry lintels.
 - C. The completed installation of thru-wall flashing shall render the building water tight except at door and window openings.

3.3 INSTALLATION – SELF-ADHERING SHEET FLASHING

- A. Install all self-adhering sheet flashing and dampproofing in strict accordance with the manufacturer's specifications and recommendations.
 - 01 Take all necessary precautions to eliminate fish-mouths and other irregularities. Where they occur, cut out and apply additional layer(s) of thru-wall flashing as required to achieve a smooth surface.
 - 02 Carefully construct corner assemblies and vertical transitions / steps to assure proper lapping of adjacent sheets to provide positive drainage. Lap joints shall be a minimum of 4 inches.
 - 03 All thru-wall flashing shall be installed prior to application of dampproofing.
- B. Do not extend self-adhering sheet flashing at masonry / brick ledges and lintels to face of masonry. Cut back 1/2" to 3/4" from exterior face.
- C. Carefully coordinate with the Masonry Contractor to install thru-wall flashing at the proper brick course(s). Thru-wall flashing shall form a continuous barrier at all transitions.

3.4 TESTING AND INSPECTING

- A. Not more than ten (10) days after completion of this portion of the Work, at the discretion of the Architect, demonstrate by running water test that the Work of this Section will successfully repel water.
 - 01 Notify the Architect at least 48 hours in advance, and conduct the test in the Architect's presence.
 - 02 By means of an outrigger, or similar acceptable equipment, place the nozzle of a 3/4 inch garden hose at a point approximately 10'-0" away from top of wall where approved by the Architect, aiming the nozzle at slight downward angle to direct full stream of water onto wall.
 - 03 Run water onto wall at full available force for not less than four hours.
 - 04 Upon completion of the four-hour period, inspect interior surfaces of wall for evidence of moisture penetration.

- B. If evidence of moisture penetration is discovered, apply an additional coat of dampproofing to the exterior surface in areas directed by the Architect. Repeat application and testing at no additional cost to the Owner, until no evidence of moisture penetration is found.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work: roof accessories as indicated on the Drawings, including, but limited to:
 - 01 Roof equipment curbs.
 - 02 Expansion joints.
 - 03 Roof equipment supports.
 - 04 Pipe supports.
- C. Related Work:
 - 01 Section 05 12 00 – Structural Steel Framing
 - 02 Section 05 21 00 – Steel Joist Framing
 - 03 Section 07 72 23 – Roof Hatches and Vents

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.

- 01 Include recommended cleaning products and instructions for use.
- 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.
- G. Operations and Maintenance Manuals:
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to Section 01 78 23 – Operations and Maintenance Manuals.
 - 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

1.3 INSTALLATION RESPONSIBILITY

- A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashings and equipment supports that may be specified elsewhere.
- B. Coordinate the work specified herein with the following Work:
 - 01 Roofing.
 - 02 Roofing Sheet Metal.
 - 03 Mechanical Equipment.
 - 04 Plumbing.
 - 05 Light Weight Insulating Concrete.

PART 2 - PRODUCTS

2.1 PREFABRICATED ROOF CURBS

- A. Design of roof curbs is based on products manufactured by Thybar Corporation.
- B. Acceptable manufacturers: The following manufacturers are acceptable to provide Roof Curbs provided proposed product(s) meet or exceed all specified requirements.
 - 01 Custom Curb, Inc.
 - 02 The Pate Co.
- C. Curbs: Design is based on Thybar model TC-3 series roof curbs.
 - 01 Manufactured of galvanized steel meeting ASTM A653 / A653M.
 - 02 Construction Gauge: Minimum 16 gauge; and heavier where required by size and / or load of equipment. Coordinate as required.
 - 03 All seams shall be welded continuous to be water and air tight.
 - 04 Roof curb perimeter shall have a continuous 2" minimum horizontal leg at base for secure attachment to supporting steel framing.
 - 05 Height: As required to provide a minimum 8" above highest interfacing roof deck. Coordinate with roofer to confirm.
 - 06 Curbs shall be fabricated for level tops, accounting for pitch of roof steel framing / roof deck as required.
 - 07 Provide additional angle reinforcing at maximum 48" O.C. as required to support equipment.
 - 08 All curb walls shall be insulated with minimum 1-1/2" thick 3PCF rigid insulation. Provide interior, protective, sheetmetal liner to cover rigid insulation.
 - 09 Factory installed wood nailers; minimum 1-1/2" x 1-1/2".

- D. Counterflashing Cap: Minimum 18 gauge galvanized steel.
- E. Coordinate with other trades as required for exact sizes of roof curbs required and load at each location.
- F. Pipe Flashing Curbs:
 - 01 Same type of construction as roof curbs above.
 - 02 Pipe Seals: ABS cover with graduated neoprene or chlorinated polyethylene boot with two (2) stainless steel adjustable clamps per pipe boot.
 - 03 Coordinated with other trades as required for exact sizes, pipe quantities and pipe diameters.

2.2 EQUIPMENT SUPPORTS

- A. Design of equipment supports is based on products manufactured by Thybar Corporation.
- B. Acceptable manufacturers: The following manufacturers are acceptable to provide Roof Curbs provided proposed product(s) meet or exceed all specified requirements.
 - 01 Custom Curb, Inc.
 - 02 The Pate Co.
- C. Equipment Supports: Design is based on Thybar model TEMS-3 series equipment supports.
 - 01 Manufactured of galvanized steel meeting ASTM A653 / A653M.
 - 02 Construction Gauge: Minimum 18 gauge; and heavier where required by size and / or load of equipment. Coordinate as required.
 - 03 Nominal width: 5".
 - 04 All seams shall be welded continuous to be water and air tight.
 - 05 Equipment supports perimeter shall have a continuous 2" minimum horizontal leg at base for secure attachment to supporting steel framing.
 - 06 Height: As required to provide a minimum 8" above highest interfacing roof deck. Coordinate with roofer to confirm.
 - 07 Equipment supports shall be fabricated for level tops, accounting for pitch of roof steel framing / roof deck as required.
 - 08 Internal bulkhead reinforcement as required for imposed load.
 - 09 Factory installed, treated 2x6 wood nailer, continuous.
- D. Counterflashing Cap: Minimum 18 gauge galvanized steel.
- E. Coordinate with other trades as required for exact sizes of roof curbs required and load at each location.

2.3 ROOF TO ROOF EXPANSION JOINT

- F. Design of roof to roof expansion joints is based on products manufactured by Johns Manville.
- G. Acceptable manufacturers: The following manufacturers are acceptable to provide roof to roof expansion joints, provided proposed product(s) meet or exceed all specified requirements.
 - 01 BASF Architectural / Building
 - 02 Nystom.

- H. Roof to roof expansion joints: Design is based on John Manville Model CF curb to curb series roof to roof expansion joints.
 - 01 Manufactured of minimum 26 gauge galvanized steel.
 - 02 Nominal width: As indicated on the Drawings; minimum 4".
 - 03 Membrane cover: minimum 60 mil EPDM.
 - 04 Height: As required to provide a minimum 8" above highest interfacing roof deck. Coordinate with roofer to confirm.
 - 05 Provide taper to nominal roof level at roof edges.
- I. Warranty: Provide a minimum ten (10) year manufacturer's warranty against defects and weather-tightness.

2.4 PIPE SUPPORTS

- A. Design of pipe supports is based on products manufactured by PHP Systems / Design (PHPSD).
- B. Design of pipe supports is based on PHPSD Pipe Supports as follows:
 - 01 Series SS-8 for lines 2-1/2" or less.
 - 02 Series PP-10 for lines up to 3-1/2".
 - 03 Series RB-18 for lines 4" to 6".
- C. Roller type pipe support specifically designed for installation without roof penetrations or flashing.
- D. Base Material: high density / high impact polypropylene with integral UV protection.
- E. Minimum 12 gauge, channel type steel framing with roller system. Hot dipped galvanized after fabrication.
- F. Provide accessory clamps, bolts, nuts, washers and other devices required for a complete installation.
- G. Provide protective traffic pads at each pipe support as recommended by roofing system manufacturer. Coordinate with other trades as required.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate all trades as required for proper design, sizing and locations of equipment curbs and equipment supports.
 - 01 Coordinate with Steel Fabrication and Erection Contractors to provide a continuous bearing all 4 sides of equipment curbs. Minimum size: 3-1/2x3-1/2 x 1/4" angle.
 - 02 Coordinate with Steel Fabrication and Erection Contractors to provide a continuous bearing all below sides of equipment supports. Minimum size: 3-1/2x3-1/2 x 1/4" angle.
 - 03 Coordinate with Roofing Contractor for proper flashing and interface with equipment curbs and supports.

- B. Coordinate all trades as required for types, sizing and locations of roof ladder anchoring into exterior walls.
 - 01 Set anchoring devices in place prior to installation of weather barrier to assure a weather-tight seal at anchors.

3.2 INSTALLATION

- A. Install all roofing according in strict accordance with manufacturer's printed instructions and final reviewed Shop Drawings.
- B. Coordinate with roofing operation for flashing and interface to provide a watertight installation.
- C. Install sealant conforming to FS TT-S-00227E, Type II, Class A, as required.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 This Section includes exterior building and site work sealants.
 - 02 Sealants for moving joints.
 - 03 Interior caulking.
 - 04 Provide foam backer rods where shown or required for proper installation of sealants.
- C. Related Work:
 - 01 Section 08 80 00 – Glazing
 - 02 Section 32 13 13 – Concrete Paving and Flatwork

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 01 If products from an acceptable manufacturer are being submitted, specifically cross reference the proposed products to the listed as the basis of design products.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.

- 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
- G. On-site sample for Architect's approval of colors.
- H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.2 REFERENCES

- A. ASTM International:
 - 01 ASTM C510 – Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants.
 - 02 ASTM C661 – Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
 - 03 ASTM C719 – Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
 - 04 ASTM C794 – Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
 - 05 ASTM C834 – Specification for Latex Sealants.
 - 06 ASTM C920 – Specification for Elastomeric Joint Sealants.
 - 07 ASTM C1087 – Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
 - 08 ASTM C1193 – Guide for Use of Joint Sealants.
 - 09 ASTM C1247 – Standard Test Method for Durability of Sealants Exposed to Continuous Immersion in Liquids.
 - 10 ASTM C1248 – Test Method for Staining of Porous Substrate by Joint Sealants.
 - 11 ASTM C1311 – Specification for Solvent Release Sealants.
 - 12 ASTM C1330 – Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
 - 13 ASTM D412 – Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
 - 14 ASTM D624 – Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 15 ASTM D2203 – Standard Test Method for Staining from Sealants.
 - 16 ASTM D2240 – Test Method for Rubber Property - Durometer Hardness.
- B. NSF International:
 - 01 NSF Standard 51 – Food Equipment Materials.
- C. U.S. Food and Drug Administration (FDA):
 - 01 21 CFR 177.2600 - Title 21 Part 177 Indirect Food Additives: Polymers

1.3 WARRANTY

- A. Warrant the Work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.

- B. Warrant exterior joints against failure of the joint to effectively seal out water or moisture. Warrant interior joints against cracking, crazing separation of the material from the substrate or other joint failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design is based on products manufactured by Tremco.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Dow Chemical Co.
 - 02 Pecora, Inc.
 - 03 Sonneborn
 - 04 Manufacturers of products bearing the Thiokol Corporation seal of approval. All polysulfide sealants shall bear the seal.

2.2 MATERIALS

- A. Caulking for exposed non-working interior locations at all hollow metal frames and abutting surfaces at ceiling, wall angles and all other locations for finished appearance:
 - 01 Type: Tremco "THC-901".
 - 02 A multi-component, polyurethane sealant providing a fast-setting pliable seal with minimal shrinkage.
- B. Exterior concrete horizontal joints, including drives, parking, sidewalks, play surfaces and other flatwork:
 - 01 Type: Tremco Vulkem 45SSL.
 - 02 High performance multi-component, chemically curing polyurethane sealant.
- C. Exterior highly active joints in walls, masonry or concrete fences:
 - 01 Type: Tremco Dymeric.
 - 02 Gun grade, general purpose multi-component, chemically curing polyurethane sealant.
- D. Exterior joints around windows, glazing, entrances, soffit joints and other general sealant areas:
 - 01 Tremco Spectrem 2.
 - 02 Medium-modulus, one-part, high performance, neutral-cure silicone sealant.
- E. Exterior joints of concrete tilt-wall panels.
 - 01 Tremco Dymonic 100.
 - 02 High performance, medium-modulus, low VOC, UV-stable, non-sagging polyurethane sealant.
- F. Interior Expansion Contraction or Control Joints where movement is to be accommodated: Tremco "Mono".
 - 01 Tremco Spectrem 2.
 - 02 Medium-modulus, one-part, high performance, neutral-cure silicone sealant.

- G. Interior General Purpose:
 - 01 Tremco Tremflex 834.
 - 02 High performance, one-part acrylic latex sealant.
- H. Primers, Cleaners, Top Coats: Use only materials listed as suitable in resistance to staining, compatibility and durability before proceeding.
- I. Back-Up Filler: Closed cell or open cell, non-gassing filler as recommended by sealant manufacturer.
- J. Sealant colors shall be as selected by the Architect from manufacturer's full range of color selections.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine all assemblies to receive sealant and verify all Work is complete as required for the proper installation of sealant.
- B. Do not accept joints that are wider than joint width limitations of the sealant to be used.
- C. Notify Contractor of any irregularities and / or discrepancies and do not proceed until fully resolved.

3.2 APPLICATION

- A. Temperatures: Do not install sealants when air temperature is under 40°F. Sealants may be warmed to ease installation when recommended by the manufacturer.
- B. Tooling:
 - 01 Tool exposed joints to a slightly concave surface using slicking materials recommended by the manufacturer.
 - 02 The tooling procedure shall press sealant against the sides of the groove.
 - 03 No materials shall be left "feathered" out or smeared on the abutting materials.
 - 04 If necessary, protect adjacent surfaces with tape.
 - 05 Completed joints shall have a uniform professional appearance.
 - 06 Use an anti-tack compound on sealant that does not set up fast enough to avoid dust collection.
- C. Sealant Back-Up: Provide a back-up filler where groove depth is too great to fill with sealant. Review joint design with Architect.
- D. Compressive Filler: Seal vertical expansion joints with fillers. Provide compressible filler twice the width of the joint and with a depth of one and one-half times the compressed width. Lap ends a minimum of 2 inches.
- E. Seal ends together in such a manner to allow natural drainage.
 - 01 Install filler by compressing material and sliding into joint.

- 02 Align filler on one face of the joint before it expands to the full joint width.

3.3 CLEAN-UP

- A. Immediately following installation of sealants, remove all excess sealant as required to result in clean sealant lines and applications.
- B. Protect sealant installations as required until sealant has reached final set.

END OF SECTION

SECTION 07 95 00

EXPANSION JOINT COVERS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work: Provide expansion joint covers as indicated on the Drawings, including, but limited to:
 - 01 Floor to floor conditions
 - 02 Floor to wall conditions
 - 03 Interior wall to wall conditions
 - 04 Exterior wall to wall conditions.
 - 05 Roof expansion joints are specified in Section 07 XX XX – Roofing and / or Section 07 62 00 – Sheet Metal Flashing.
- C. Related Work:
 - 01 Section 05 50 00 – Metal Fabrications
 - 02 Section 07 XX XX – XXXXX Roofing
 - 03 Section 07 62 00 – Steel Metal Flashing
 - 04 Section 09 21 16 – Gypsum Board Assemblies

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies in actual conditions within the Work of this Project.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 6" in length, but must be large enough to convey attributes of the proposed product.
 - 04 Provide sample of the proposed assembly(s); 6" minimum length.
- G. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 01 ASTM A240 / A240-M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
 - 02 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 03 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 04 ASTM C510 – Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
 - 05 ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer
 - 06 ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness.
 - 07 **ASTM E330** - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - 08 ASTM E1399 - Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
- B. American Architectural Manufacturers Association (AAMA):
 - 01 AAMA 611, Class II Anodic Aluminum Finishes
- C. National Association of Architectural Metal Manufacturers (NAAMM):
 - 01 Metal Finishes Manual for Architectural and Metal Products.

1.4 WARRANTY

- A. All expansion joint covers shall be covered by manufacturer's five (5) year warranty against manufacturer's defects and becoming unserviceable for the intended purpose.

PART 2 - PRODUCTS

2.1 INTERIOR EXPANSION JOINT COVERS

- A. Design of interior expansion joint covers is based on products manufactured by C-S Group.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Emseal
 - 02 Inpro Corporation
 - 03 Nystrom
- C. General Materials:
 - 01 Aluminum: ASTM B 221, Alloy 6063-T5, 6063-T6, 6063-T52, 6061-T5, 6061-T6, 6061-T51, 6105-T5, 6105-T6, 6005-T5, 6005A-T5, 6005A-T61 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.
 - 02 Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
 - 03 Clear Anodized Finish: Class II, Clear Anodic Finish: AA-M12C22A31 complying with AAMA 611.
 - 04 Bronze Anodized Finish: Class II, Color Anodic Finish: AA-M12C22A32/A34 (complying with AAMA 611.
 - 05 Stainless Steel Finish: ASTM A240A / A240M - Type 304 for plates, sheet, and strips.
 - a. Finish: No.4, directional satin.
 - b. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches.
 - c. Run grain with long dimension of each piece.
 - 06 Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
 - 07 Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
 - 08 Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
 - a. Provide at expansion joint covers at 2nd floor assemblies as required to maintain specified fire rating.
 - b. Provide at expansion joint covers at rated partition assemblies as required to maintain specified fire rating.
- D. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated.
 - 01 While specified joint systems establish the function and aesthetic intent, it may be necessary for the manufacturer to modify the joint systems to accommodate the movement requirements as scheduled in the contract documents.
 - 02 Such modifications should be made without significant changes to the aesthetic or functional intent of the joint systems.
 - 03 Provide units with capability to accommodate variations in adjacent surfaces.

- E. Design architectural joint systems for the following size and movement characteristics:
 - 01 Nominal Joint Width: 1"
 - 02 Maximum Joint Width: 1-1/4"
 - 03 Minimum Joint Width: 3/4".
- F. Floor-To-Floor Expansion Joint Covers: Design is based on C-S Group model GFST series.
 - 01 Aluminum Extrusions: Type as recommended by the manufacturer, in compliance with ASTM B221.
 - 02 Primary Seal: Dual durometer TPR gasket, 65 shore A, 90 Shore A, ASTM D2240.
 - 03 Gasket color as selected by the Architect from manufacturer's full range of selections.
- G. Floor-To-Wall Expansion Joint Covers; Design is based on C-S Group model GFSTW series.
 - 01 Same properties as floor-to-floor expansion joint cover.
- H. Wall-To-Wall Expansion Joint Covers: Design is based on C-S Group model FWF series.
 - 01 Aluminum Extrusions: Type as recommended by the manufacturer, in compliance with ASTM B221.
 - 02 Primary Seal: Dual durometer TPR gasket, 65 shore A, 90 Shore A, ASTM D2240.
 - 03 Gasket color as selected by the Architect from manufacturer's full range of selections.
- I. Gypsum Board Ceiling-To-Ceiling Expansion Joint Cover: Design is based on C-S Group model FWF series.
- J. Above expansion joint covers installed in rated assemblies shall be the same model number with addition of manufacturer's materials required for a 1-hour or 2-hour fire rated assembly as indicated on the Drawings.

2.2 EXTERIOR EXPANSION JOINT COVERS

- A. Design of exterior expansion joint covers is based on products manufactured by C-S Group.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Emseal
 - 02 Inpro Corporation
 - 03 Nystrom
 - 04 Tremco

- C. Vertical Wall-To-Wall Expansion Joints at Masonry Veneer: Design is based on C-S Group model VF series.
 - 01 A precompressed low-modulus silicone with an open-cell polyurethane foam infused with a water-based, non-drying acrylic dispersion.
 - 02 Color as selected by the Architect from manufacturer's full range of color selections, minimum 12.
 - 03 Durometer Hardness: ASTM C661, Shore AI, Silicone coating – not to exceed 15 pts (+/-5).
 - 04 Weatherometer: ASTM C510, Xenon Arc Weatherometer 2000 hours – no visible deterioration.
 - 05 Wind Loading: ASTM E330, 150 MPH wind equivalent, +/- 0.1 mm net deflection
 - 06 Water Penetration: ASTM E331-00, No water penetration after consecutive 15-minute soak durations under pressures of: 500 ΔP(Pa), 65 mph equivalent wind driven rain; 1000 ΔP(Pa), 92 mph equivalent wind driven rain; 5000 ΔP(Pa), 205 mph equivalent wind driven rain.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate all trades as required for proper design, sizing and locations of interfacing work to accommodate expansion joint covers.
 - 01 Verify flooring type to be installed at floor-to-floor expansion joint covers; and shim as required to match flooring height within 1/16".
 - 02 Coordinate with drywall trades as required to properly float drywall at wall-to-wall expansion joint covers.
 - 03 Coordinate with masonry trades as required to provide flush struck end joints at masonry to interface with exterior wall-to-wall expansion joint covers
- B. Examine surfaces and interfacing Work where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Prepare substrates according to architectural joint system manufacturer's written instructions.

3.2 INSTALLATION

- A. Install all expansion joint covers in strict accordance with manufacturer's printed instructions and final reviewed Shop Drawings.
- B. Coordinate and furnish anchorages, Setting Drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all interior and exterior hollow metal frames, including interior glazed opening frames, where indicated or scheduled on the Drawings.
 - 02 Provide all interior and exterior hollow metal doors where indicated or scheduled on the Drawings.
- C. Related Work:
 - 01 Section 01 22 00 – Unit Prices
 - 02 Section 04 20 00 – Unit Masonry
 - 03 Section 07 92 00 – Joint Sealants
 - 04 Section 08 14 23.16 – Plastic-Laminate-Faced Wood Doors
 - 05 Section 08 71 00 – Door Hardware
 - 06 Section 08 80 00 – Glazing
 - 07 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 01 Show or schedule location, size, thickness, elevation, details of construction, location and extent of hardware blocking, fire rating and other pertinent data for each door required.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Finish Hardware Location: Hollow metal manufacturer shall obtain an approved hardware schedule, hardware templates and samples of physical hardware where necessary to ensure correct fitting and installation.
- E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

- 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
- 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

1.3 REFERENCES

- A. ASTM International (ASTM):
- 01 A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 02 ASTM A366 - Steel, carbon, cold-rolled sheet, commercial quality.
 - 03 ASTM A526 - Steel sheet, zinc-coated (galvanized) by hot dip process, commercial quality.
 - 04 A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip.
 - 05 A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
 - 06 B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 07 B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - 08 B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 09 B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
 - 10 D3656/D3656M-13 - Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns.
 - 11 E90-09 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- B. National Association of Architectural Metal Manufacturers (NAAMM), AMP 500-06 - Metal Finishes Manual.
- C. National Fire Protection Association (NFPA), NFPA 80-16 - Fire Doors and Other Opening Protectives.
- D. UL LLC (UL):
- 01 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
 - 02 1784-15 - Air Leakage Tests of Door Assemblies and Other Opening Protectives.
- E. American National Standards Institute:
- 01 ANSI A151-1-1969, Test Method for Standard Steel Doors.
 - 02 ANSI A250.11-2001 Recommended Erection Instructions for Steel Frames.

1.4 DELIVERY AND HANDLING

- A. Deliver, store and handle hollow metal work in strict accordance with manufacture's recommendations to prevent damage, rust and deterioration.
- B. Store materials in a covered, dry location and promptly clean and touch-up scratches or rust spots with a rust-inhibitive primer.
- C. Doors shall have their wrappings or coverings removed upon delivery at the building site and shall be stored in a vertical position spaced by locking for air circulation.
- D. Doors and frames shall be clearly identified with opening number as indicated on the Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Hollow metal door and frame manufacturers shall be members of the National Association of Architectural Metal Manufacturers (NAAMM).
- B. The following manufacturers are acceptable to provide hollow metal doors and frames subject to meeting all provisions and requirements of this Section of Specifications:
 - 01 American Door Products
 - 02 Ceco / United Dominion Industries
 - 03 Curries
 - 04 Door Pro Systems
 - 05 Pearland Industries
 - 06 Republic Doors and Frames
 - 07 Steelcraft

2.2 MATERIALS

- A. Doors:
 - 01 Doors shall be custom made, of types and sizes shown on reviewed Shop Drawings, and shall be fully welded seamless construction with no visible seams or joints on faces or vertical edges.
 - 02 Minimum door thickness shall be 1 3/4 inches, unless specifically noted or shown differently.
 - 03 Doors shall be strong, rigid and neat in appearance, free from warp and buckle. Corner bends shall be true and straight and of minimum radius for gauge of metal used.
 - 04 Provide 22-gauge steel stiffeners spaced max. 6-inch O.C. and extending full height of door.
 - 05 Fill interior with foamed in place urethane. Use mineral filler as required for labeled doors.
 - 06 Door Face Gauges:
 - a. Doors 36" wide or less shall be 16 gauge galvanized.
 - b. Doors 37" wide or more shall be 14 gauge galvanized.
 - 07 Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to provide a smooth flush surface.

- 08 Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot welded to both faces.
- a. Exterior doors shall have an additional flush closing channel at top and bottom edges.
 - b. Openings shall be provided in the bottom closure channel at top and bottom edges.
 - c. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
- 09 Edge profile shall be provided on both vertical edges of door as follows:
- a. Single-acting swing doors - beveled 1/8 inch in 2-inch.
- 10 Hardware Reinforcements:
- a. Doors shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware, in accord with the reviewed hardware schedule and template provided by Section 08 71 00 - Door Hardware. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.
 - b. Minimum gauges for hardware reinforcing plates shall be as follows:
 - 1. Hinge & pivot reinforcements: 7 gauge.
 - 2. Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.
 - 3. Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.
 - 4. Channel / U-reinforcing at door lights shall be minimum 20 gauge; continuous all sides.
- 11 Edge Clearances:
- a. Between door and frame at head and jambs: 1/8 inch.
 - b. At door sills with no threshold, 5/8 to 3/4 inch above finished floor.
 - c. At door sills with threshold, as required to suit threshold.
 - d. Between meeting edges of double doors - 1/8 inch.
- 12 Door Lite Kits: Design is based on Curries Type 9 Window Molding; 20 gauge, galvanized material; wrap-around configuration, secured with vandal-proof fasteners.
- 13 Door Louvers: Fabricate from minimum 20 gauge and galvanized material; inverted "Y" blade, sight-proof type, unless otherwise shown. Louver frame shall be wrap-around type secured with vandal-proof fasteners.

B. Frames:

- 01 Frames for exterior openings shall be made of commercial cold rolled steel conforming to ASTM A366 and shall be galvanized after fabrication.
- 02 Frames for interior openings shall be a) commercial grade, cold-rolled steel conforming to ASTM A366 or b) commercial grade hot rolled and pickled steel conforming to ASTM A569.
- 03 Door Frame Gauges:
- a. Exterior opening frames 48" wide or less shall be 14 gauge.
 - b. Exterior opening frames 49" wide or more shall be 12 gauge.
 - c. Interior opening frames 48" wide or less shall be 16 gauge.
 - d. Interior opening frames 49" wide or more shall be 14 gauge.
- 04 Window Frame Gauges:

- a. Interior opening frames with jamb / vertical mullions width / spacing 72" wide or less, and 30 SF or less shall be 16 gauge.
 - b. Interior opening frames with jamb / vertical mullions width / spacing 73" wide or more, and greater than 30 SF shall be 14 gauge.
- 05 Frames shall be custom made, welded units with integral trim of sizes and shapes shown on Drawings and required for the specific intended use.
 - a. Door stops shall be nominal 5/8".
 - b. Returns shall be 1/2".
- 06 Frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile throughout their length.
- 07 Jamb depths and profile shall be as shown on Drawings and required for the specific intended use.
- 08 Corner joints shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted.
- 09 Minimum depth of stops shall be 5/8 inch.
- 10 Frames for multiple openings shall have mullion and rail members which are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth.
- 11 Hardware Reinforcements: Frames shall be mortised, reinforced, drilled and tapped at factory for fully templated hardware in accordance with finish hardware schedule and templates provided by Section 08 71 00 - Door Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
- 12 Minimum thickness of hardware reinforcing plates shall be as follows:
 - a. Hinge and pivot reinforcements (1-1/4" x 10" minimum size): 7 gauge.
 - b. Strike reinforcements: 12 gauge.
 - c. Flush bolt reinforcements: 12 gauge.
 - d. Closer reinforcements: 12 gauge.
 - e. Reinforcements for surface-mounted hardware, hold-open arms, surface panic devices: 12 gauge.
- 13 Floor anchors shall be securely welded inside each jamb, with holes for floor anchorage.
- 14 Jamb Anchors for frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-Strap type. Anchors shall be not less than 16-gauge steel. The number of anchors provided at each jamb shall be as follows:
 - a. Frames up to 7'-6" height - 3 anchors.
 - b. Frames 7'-6" to 8'-0" height - 4 anchors.
 - c. Frames over 8'-0" height - 1 anchor for each 2 feet, or fraction thereof in height.
- 15 Jamb Anchors for frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16-gauge thickness, securely welded inside each jamb as follows:
 - a. Frames up to 7'-6" height - 4 anchors.
 - b. Frames 7'-6" to 8'-0" height - 5 anchors.
 - c. Frames over 8'-0" height - Four anchors plus one additional for each 2 feet, or fraction thereof over 8'-0".
- 16 Jamb Anchors for frames to be anchored to previously placed concrete, masonry or structural steel shall be provided with anchors of suitable design as shown on reviewed shop drawings.

- 17 Dust cover boxes of not less than 26-gauge steel shall be provided at all mortised hardware items.
 - 18 Frames shall be provided with steel spreader temporarily attached to bottoms of both jambs for bracing during shipping and handling.
 - 19 Glass stops for interior glazed frames shall be loose stops, not less than 18-gauge steel, 1/2" x 1/2", with butt corner joints, secured to frame opening by countersunk tamper proof screws. Snap-on attachments will not be acceptable.
 - 20 Prepare frame for silencers. Provide three single silencers for single doors on strike side. Provide two single silencers on frame head at double doors without mullions.
- C. Finish: Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
- 01 Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
 - 02 Chemically treat surfaces and apply one coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.
 - 03 Frames at exterior openings shall be coated on the inside of the frame with a commercial grade, water-based mastic compound (or other approved coating material) prior to installation; 20 mil minimum coating / coverage.
- D. Labeled Doors and Frames:
- 01 Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled. Such doors and frames shall be constructed as tested and approved by Underwriters Laboratories or other nationally recognized testing agency having a factory inspection service.
 - 02 If any door or frame scheduled to be fire rated cannot qualify for appropriate labeling because of its size, design, hardware or other reason; the Architect shall be so advised before fabrication work on that item is started.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Separate dissimilar metals, protect against galvanic action.
- B. Frames:
- 01 Anchorage and Connections: Firmly anchor and secure to adjacent construction in strict accordance with manufacturer's Shop Drawings and installation instructions.
 - 02 Frame Spreader Bars: Leave intact until frames are set permanently square and plumb and frame anchors are securely attached.
 - 03 Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed.
 - 04 Installation of labeled frames shall conform to National Fire Protection Association Pamphlet No. 80, "Fire Door and Windows" and UL design requirements.
 - 05 At exterior locations, coat interior of frame with mastic or other approved coating material prior to installation; minimum 20 mil thickness.

- C. Doors:
 - 01 Hang doors square, plumb and straight, firmly anchored into position. Eliminate hinge bound conditions and making all items smooth operating. Adjust operable parts for correct functions.
 - 02 Apply hardware in accordance with hardware manufacturer's templates and instructions.
 - 03 Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed.
 - 04 Installation of labeled doors shall conform to National Fire Protection Association Pamphlet No. 80, "Fire Doors and Windows" and UL design requirements.
- D. Coordinate with other trades as required for installation of glass and glazing to be installed in doors and frames.
- E. Immediately after erection, sand smooth all rusted and damaged areas of prime coat and apply touch-up with compatible air-drying primer.

END OF SECTION

SECTION 08 14 23.16

PLASTIC LAMINATE FACED WOOD DOORS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide solid core, plastic laminate faced, wood doors in sizes and styles as indicated and scheduled on the Drawings.
- C. Related Work:
 - 01 Section 08 11 13 – Hollow Metal Doors and Frames
 - 02 Section 08 11 16 – Aluminum Door and Glazing Frames
 - 03 Section 08 71 00 – Door Hardware

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
 - 01 Show or schedule location, size, thickness, elevation, details of construction, location and extent of hardware blocking, fire rating and other pertinent data for each door required.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each plastic laminate finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
- G. Provide a copy of the lifetime warranty to be issued for contract close-out.
- H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 02 ASTM E413 - Classification for Rating Sound Insulation.
- B. American National Standards Institute (ANSI), ANSI A208.1 - Particleboard.
- C. American Woodworking Institute (AWI), AWI/AWMAC/WI Architectural Woodwork Standards, Section 9 - Doors.
- D. Wood Door Manufacturer's Association (WDMA):
 - 01 WDMA I.S.1-A - Architectural Wood Flush Doors.
 - 02 WDMA I.S. 10 - Industry Standard for Testing Cellulosic Composite Materials for Use in Fenestration Products.
- E. National Fire Protection Association (NFPA):
 - 01 NFPA 80 - Standard for Fire Doors and Other Opening Protectives.
 - 02 NFPA 252 - Standard Methods of Testing pf Door Assemblies.
- F. Underwriters Laboratories:
 - 01 UL 10-C - Standard for Positive Pressure Fire Tests of Door Assemblies.
 - 02 UL Label Fire Door; All fire rated doors shall bear a UL identification on the hinge stile.

1.4 QUALITY ASSURANCE

- A. High pressure decorative laminate faced doors shall conform to the latest edition of the following standards:
 - 01 WDMA I.S. 1-A.
 - 02 AWI Standards and requirements for "Premium Grade".
- B. Tolerances for warp, telegraphing, squareness, and pre-fitting dimensions as per the latest edition of WDMA I.S. 1-A.
- C. Identifying Label: Each door shall bear identifying label indicating:
 - 01 Door manufacturer.
 - 02 Order number.
 - 03 Door number.
 - 04 Fire rating, if applicable.

- D. Environmental Responsibility: Provide doors manufactured with the following environmentally responsible components:
 - 01 Core: Particle Board; no added urea-formaldehyde.
 - 02 Composite Crossband: High-Density Fiberboard (HDF); no added urea-formaldehyde.
 - 03 Stiles and Rails: Structural Composite Lumber (SCL); no added urea-formaldehyde.
- E. Where fire rated doors are required, provide labeled doors. Construction details and hardware application shall be as approved by the labeling agency.

1.5 WARRANTY

- A. All doors shall be warranted for the life of the door under normal use against material defects, warping, and delamination of laminate facing and becoming unserviceable.
- B. Any defects noted during the warranty period shall be corrected at no cost to the Building Owner. Such corrective work shall include all labor and material for repair, replacement, refinishing and re-hanging as required.
- C. Provide Manufacturer's executed, written lifetime warranty with close-out documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of Plastic Laminate Faced Doors is based on products manufactured by VT Industries.
- B. Acceptable Manufacturers: the following manufacturers are acceptable to provide plastic laminate clad doors provided proposed products meet or exceed all specified requirements:
 - 01 Alfab, Inc.
 - 02 Graham Manufacturing Co.
 - 03 Marlite
 - 04 Marshfield Door Systems
 - 05 Mengel Wood Industries, Inc.
 - 06 Ragland Manufacturing Co.
- C. Plastic Laminate: The following manufacturers are acceptable to provide plastic laminate:
 - 01 Ralph Wilson Plastics, "Wilsonart".
 - 02 Formica Corp., "Formica".

2.2 MATERIALS - DOORS

- A. Design of solid-core plastic laminate clad doors is based on VT Industries Heritage Collection series 303H doors.
- B. All doors shall be 1-3/4" thick.

- C. Core Material:
 - 01 Core Material: Particle Board Core for non-rated and 20-minute fire-rated doors; mineral for 1-1/2 hour-rated doors.
 - 02 Density: minimum 28-32 PCF. Comply with particleboard standard ANSI A208.1, Grade 1-LD-2.
 - 03 Composite Crossband.
- D. Door Stiles:
 - 01 Door Stiles: minimum 1-3/8" (nominal) Structural Composite Lumber (SCL) bonded to core with minimum 1/16" hardwood veneer suitable for staining or painting to approximate plastic laminate finish as selected by the Architect.
 - 02 Vertical door edges shall be factory painted / stained to match door face. Factory shall supply matching paint / stain and edges shall be touched-up in field.
 - 03 Plastic laminate stiles shall not be acceptable.
- E. Door Rails:
 - 01 Door Rail: minimum 1-3/8" (nominal) Structural Composite Lumber (SCL).
 - 02 Minimum 6" head rail at all doors to receive a closer.
 - 03 Seal top, bottom and cut surface of openings at factory with two coats of varnish.
 - 04 Where head rail may be visible from a second story vantage point, head rail shall be stained or painted to match stiles.
 - 05 Glass Lite Frames / Stops: Metal type with painted finish. Coordinate with other trades as required.

2.3 MATERIALS – PLASTIC AMINATE

- A. Horizontal grade, 0.048" minimum thickness.
- B. Finish shall be as selected by the Architect from manufacturer's full range of colors and finishes.
- C. Laminate shall be applied to the core by a hot press method using Type 1 exterior grade, water resistant adhesive.

2.4 DOOR LITE FRAMES

- A. Design of door lite framing for glass inserts is based on National Guard Products (NGP) model L-FRA100 Low Profile Lite Kit.
 - 01 Other manufacturers shall be considered provide proposed products meet or exceed all specified requirements.
 - 02 Provide in sizes as indicated on the Drawings.
 - 03 Suitable for 1/4" glazing.
- B. Design of door lite framing for louver inserts is based on National Guard Products (NGP) model L-FRA100-SP Low Profile Lite Kit for Variable Insert Thickness.
 - 01 Other manufacturers shall be considered provide proposed products meet or exceed all specified requirements.
 - 02 Provide in sizes as indicated on the Drawings.
 - 03 Suitable for 1/4" glazing.
- C. Fabricated from minimum 18 gauge cold rolled steel.

- D. Welded construction with mitered corners.
- E. One-sided countersunk screw mounting.
- F. Provide with gray primed powder coat finish; to be field painted in color as selected by the Architect.

2.5 FABRICATION

- A. Stile Edges: Apply hardwood edges before application of face laminates.
- B. Prefit Doors:
 - 01 Prefit and bevel doors at factory to fit openings.
 - 02 Prefit Tolerances: WDMA I.S.1-A.
- C. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts required.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine locations to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.
- B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.
- C. Ensure frames are plumb, level, square, and within tolerance.
- D. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 24 hours before installation.

3.2 INSTALLATION

- A. Carefully verify that doors are properly installed at intended door location and that door prep for finish hardware is accurate and complete.
- B. Install all doors plumb and square to frame with +/- 1/8" clearance between door and frame.
- C. Install finish hardware in accordance with approved templates.
- D. Verify that top and bottom rails are sealed prior to door installation.
- E. Take all necessary precautions to protect door finishes before, during and after installation. In the event of damage to the plastic laminate surfacing, replace door.

- F. Do not strip heads of Phillips head screws. Remove and replace all stripped screws.
- G. Upon completion of door installation, cycle door several times to confirm that door, frame and hardware are all installed and functioning correctly.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Access flush access doors where indicated on the Drawings.
 - 02 Access flush access doors at all plumbing chases. Coordinate locations with Architect.
 - 03 Provide flush access doors in horizontal gyp board and / or plaster ceilings or soffits as indicated on the Drawings.
 - 04 Where access doors are installed in a rated partition or assembly, provide fire-rated access doors.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 09 21 16 – Gypsum Board Assemblies
 - 03 Divisions 22 and 23 – Access doors for plumbing and mechanical items.
 - 04 Division 26 – Access doors for electrical items

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies. Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of access doors is based on products manufactured by Milcor, Inc.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed all specified requirements.
 - 01 Acudor Products Inc.
 - 02 The Bilco Company
 - 03 Ruskin Company

2.2 MATERIALS

- A. Design of access doors is based on Milcor:
 - 01 Series M Architectural Access Door for non-fire-rated assemblies.
 - 02 Series UFR Universal Fire Rated Access Door for rated assemblies.

2.3 ACCESS DOORS – NON-FIRE-RATED

- A. Design of non-fire-rated access doors is based on Milcor Series M Architectural Access Door.
- B. Door: 16-gauge, cold rolled steel.
- C. Frame: 16 gauge, cold rolled steel. Frame to be provided with pre-formed mounting holes 3/16" diameter at 4" spacing. Inner frame included to allow latching.
 - 01 Provide cadmium plated or stainless-steel screws as appropriate for wall substrate.
- D. Hinge: Concealed spring hinges open to 175 degrees for complete access without allowing the door to impact the wall. Quantity varies per door panel size. Extracting pin from hinge leaf attached to panel permits panel removal.
- E. Latch: Cylinder lock (replaces one cam latch) furnished with two keys. Additional custom options available upon request.
- F. Finish: Powder coat colors - Grey, Gold Sand, Jet Black as selected by the Architect.
- G. Sizes: Unless otherwise indicated on the Drawings, provide the following:
 - 01 Single User Restrooms: 18" x 18".
 - 02 Multi User Restrooms: 22" x 30".
 - 03 Gypsum Board Ceilings: 24" x 24".
 - 04 Plaster Ceilings and Soffits: 24" x 24".

2.4 ACCESS DOORS – FIRE-RATED

- A. Design of non-fire-rated access doors is based on Milcor Series UFR Universal Fire Rated Access Door.
- B. Door: 20-gauge, cold rolled steel sandwich panel with 2" mineral fiber insulation.
- C. Frame: 16 gauge 4-piece cold rolled steel with masonry anchors.
- D. Hinge: 18-gauge continuous piano hinge with stainless steel pin.
- E. Closer: Coil spring self-closing.
- F. Latch: Self-latching paddle latch and locking system with key operated cylinder lock furnished with two keys and interior release mechanism; (1) per door for sizes below 36"; (2) per door for sizes 36" - 48".
- G. Rating:
 - 01 Rating is maintained for a two-hour wall.
 - 02 Carries UL and CUL 1½ -hour, Class B fire rating.
 - 03 Warnock Hersey Label for three-hour noncombustible ceiling systems.
 - 04 UL Certified: 250°F temperature rise protection for cold rolled steel; 450°F temperature rise protection for stainless steel.
- H. Finish: Powder coat colors - Grey, Gold Sand, Jet Black as selected by the Architect.
- I. Sizes: Unless otherwise indicated on the Drawings, provide the following:
 - 01 Single User Restrooms: 18" x 18".
 - 02 Multi User Restrooms: 22" x 30".
 - 03 Gypsum Board Ceilings: 24" x 24".
 - 04 Plaster Ceilings and Soffits: 24" x 24".



08 31 13 Access
Doors.docx

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate locations with the trade that is constructing the material being penetrated.
- B. Verify by comparing packing slip and box label that product is per Specification.
- C. Verify that the substrate is dry, clean, and free of foreign matter and in compliance with requirements for installation tolerances and other conditions affecting performance. Report and correct any defects prior to any installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Refer to manufacturer's product literature for surface preparation requirements.

- 01 Surfaces should be structurally sound, free of voids, spalls, loose aggregate and sharp ridges. Remove dust, dirt, debris or any other foreign materials.

3.2 INSTALLATION

- A. Install access doors in strict accordance with manufacturer's instructions and approved submittals.
- B. Take all necessary precautions to protect adjacent work and finishes. Coordinate with other trades to repair finishes and other damaged during installation.
- C. Test units for proper function and adjust until proper operation is achieved.
- D. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace access doors with damage, bowing, or warping that interferes with the installation or functionality of product.
- B. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.
- C. Protect completed work from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide overhead coiling doors in sizes and locations as indicated on the Drawings.
 - 02 Assemblies shall be complete, including guides, hoods, operator, weather seals and accessories.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 08 33 23.13 – Overhead Insulated Coiling Doors
 - 03 Section 09 21 16 Gypsum Board Assemblies
 - 04 Section 13 34 19 – Metal Building Systems

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Provide engineering and calculations demonstrating compliance with wind load and other requirements.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey the finish attributes of the proposed product.
- G. Operations and Maintenance Manuals:
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to section 01 78 23 – Operations and Maintenance Manuals
 - 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).
- H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 02 ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 03 ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 04 ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
 - 05 ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- B. American National Standards Institute (ANSI):
 - 01 ANSI / DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.
- C. National Electrical Manufacturers Association (NEMA):
 - 01 NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 02 NEMA MG 1 - Motors and Generators.

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 01 Wind Loading: Refer to Section 01 11 23 – Code Summary.
 - 02 Cycle Life: Design doors of standard construction for normal use of up to 20 cycle per day maximum.

- 03 Insulated Door Slat Material Requirements:
 - a. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
 - b. Minimum Sound Transmission Class (STC) rating of 26 as tested per ASTM E90.
 - c. Minimum R-value of 8.0 (U-factor of 0.125) as calculated using the ASHRAE Handbook of Fundamentals.
 - d. Insulation to be CFC Free with an Ozone Depletion Potential (ODP) rating of zero.

1.5 WARRANTY

- A. Warrant the work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to the following:
 - 01 Rough or difficult operation.
 - 02 Noisy operation.
 - 03 Loose or missing parts.
 - 04 Noticeable deterioration of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of overhead coiling doors is based on products manufactured by Cornell Iron Works, Inc.
- B. The following manufacturers are acceptable provided proposed products meet or exceed performance and attributes of basis of design, and specified requirements:
 - 01 C.H.I. Overhead Doors
 - 02 Cookson Co.
 - 03 North American Door Corporation
 - 04 Overhead Door Co.

2.2 MATERIALS

- A. Design of overhead coiling doors is based on Cornell Iron Works Model ESD10 Coiling Overhead Door.
- B. Curtain:
 - 01 Slat Material: No. 6F, (Listed Exterior/Interior):
 - a. Galvanized Steel/Galvanized Steel: 24 gauge, Grade 40, ASTM A653 galvanized steel zinc coating.
 - b. Slats have a Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
 - 02 Slat Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat.
 - a. Minimum 2.5 mils cured film thickness; ASTM D3363 pencil hardness: H or better.
 - b. Color as selected by Architect from manufacturer's full range of color selections.

- 03 Bottom Bar: Reinforced extruded aluminum 6063-T5; minimum 3-3/8" height; minimum 3/16" base thickness; minimum 4" wide.
 - 04 End Locks: Alternate slats each secured with two 1/4" (6.35 mm) rivets. Fabricate interlocking sections with high strength nylon. Provide windlocks as required to meet specified wind load.
- C. Guides:
- 01 Fabricate with minimum 3/16" structural steel angles.
 - 02 Provide windlock bars of same material when windlocks are required to meet specified wind load.
 - 03 Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides.
 - 04 Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
 - 05 Top 16 1/2" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
 - 06 Finish: Steel: ASTM A123, Grade 85, zinc coating, hot-dip galvanized after fabrication.
- D. Counterbalance Shaft Assembly:
- 01 Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
 - 02 Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.
- E. Brackets: Fabricate from minimum 3/16 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
- 01 Finish: ASTM A123, Grade 85 zinc coating, hot-dip galvanized after fabrication.
- F. Hood: 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
- 01 Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, flat black.
- G. Weatherstripping:
- 01 Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides.
 - 02 Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
 - 03 Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
 - 04 Hood: Neoprene/rayon baffle to impede air flow above coil.

2.3 OPERATORS

- A. Operation - Manual Chain Hoist:
- 01 Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.
 - 02 Chain hoist to include integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

- B. Accessories: Provide all accessories required for a complete, operable assembly in accordance with manufacturer's standards and recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates, areas, and conditions for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after all unsatisfactory conditions have been corrected.
- D. Coordinate with Electrical Contractor as required for proper rough-in and final connections required for a fully functional assembly.

3.2 INSTALLATION

- A. Install in strict accordance with manufacturer's printed instructions and recommendations at locations shown on Drawings.
- B. Anchor to adjacent construction without distortion or stress.
- C. Fit and align door and shutter assembly including hardware, plumb, level and square to ensure smooth operation.
- D. Adjust hardware and moving parts so that doors operate smoothly throughout full operating range.
- E. Adjust seals to provide a tight fit around the entire perimeter.

3.3 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.4 DEMONSTRATION

- A. Prior to Owner demonstration, submit and receive approval of operation and maintenance manuals required in Section 01 77 00 – Close-Out Procedures. Provide O&M manuals to Owner prior to conducting Owner demonstration.
- B. Demonstrate proper operation to Owner's Representative.
- C. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 33 23.13

OVERHEAD INSULATED COILING DOORS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide overhead coiling doors in sizes and locations as indicated on the Drawings.
 - 02 Assemblies shall be complete, including guides, hoods, operator, weather seals and accessories.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 08 33 23.13 – Overhead Insulated Coiling Doors
 - 03 Section 09 21 16 Gypsum Board Assemblies
 - 04 Section 13 34 19 – Metal Building Systems

1.1 SUBMITTALS

- A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details.
 - 03 Show details of field fabrications, connections, and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements.
 - 05 Shop drawings shall be sealed and signed by a Texas registered engineer.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
- G. Operations and Maintenance Manuals:
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to section 01 78 23 – Operations and Maintenance Manuals
 - 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).
- H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.2 REFERENCES

- A. ASTM International:
 - 01 ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 02 ASTM A924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 03 ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 04 ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
 - 05 ASTM E 283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 06 ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- B. American National Standards Institute (ANSI):
 - 01 ANSI / DASMA 108 – American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.
- C. National Electrical Manufacturers Association (NEMA):
 - 01 NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 02 NEMA MG 1 – Motors and Generators.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 01 Wind Loading: Supply doors to withstand up to 25 PSF maximum wind load.
 - 02 Cycle Life: Design doors of standard construction for normal use of up to 20 cycle per day maximum.
 - 03 Insulated Door Slat Material Requirements:
 - a. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
 - b. Minimum Sound Transmission Class (STC) rating of 26 as tested per ASTM E90.
 - c. Minimum R-value of 8.0 (U-factor of 0.125) as calculated using the ASHRAE Handbook of Fundamentals.
 - d. Insulation to be CFC Free with an Ozone Depletion Potential (ODP) rating of zero.

1.4 WARRANTY

- A. Warrant the work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance, resulting from both defective or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to the following:
 - 01 Rough or difficult operation.
 - 02 Noisy operation.
 - 03 Loose or missing parts.
 - 04 Noticeable deterioration of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of overhead insulated Coiling Doors is based on products manufactured by Cornell Iron Works, Inc.
- B. The following manufacturers are acceptable provided proposed products meet or exceed performance and attributes of basis of design, and specified requirements:
 - 01 Cookson Co.
 - 02 North American Door Corporation
 - 03 Overhead Door Co.

2.2 MATERIALS

- A. Curtain:
 - 01 Slat Material: No. 6F, (Listed Exterior/Interior):
 - a. Galvanized Steel/Galvanized Steel: [22/22] gauge, Grade 40, ASTM A 653 galvanized steel zinc coating.
 - b. Insulation: 7/8 inch (22 mm) foamed-in-place, closed cell urethane.
 - c. Total Slat Thickness: 15/16 inch (24 mm).
 - d. Slats have a Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
 - e. Slat has an R-value of 8.0 and an STC rating of 26.

- 02 Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.
- 03 Fabricate interlocking sections with high strength [nylon] [cast iron] end-locks on alternate slats each secured with two ¼" (6.35 mm) rivets. Provide windlocks as required to meet specified wind load.
- B. Exterior Slat Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, custom color as selected by Architect; minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
- C. Interior Slat Finish: GalvaNex™ Coating System to include an ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation of a chemical bonding, light gray baked-on polyester base coat and a baked-on polyester finish coat. Color as selected by Architect from manufacturer's standard color range.
- D. Bottom Bar Finish:
 - 01 Exterior Face: Match slats
 - 02 Interior Face: Mill finish
- E. Guides: Fabricate with minimum 3/16 inch structural steel angles.
 - 01 Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides. Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
 - 02 Top 16 ½" (419.10 mm) of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
 - 03 Finish: Steel: ASTM A 123, Grade 85, zinc coating, hot-dip galvanized after fabrication.
- F. Counterbalance Shaft Assembly:
 - 01 Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
 - 02 Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.
- G. Brackets: Fabricate from minimum 3/16 inch (5 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
 - 01 Finish: ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.
- H. Hood: 24-gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.
 - 01 Finish: GalvaNex™ Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range.
- I. Weatherstripping:
 - 01 Bottom Bar: Replaceable, bulb-style, compressible EDPM gasket extending into guides.

- J. Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
Lintel Seal: Nylon brush seal fitted at door header to impede air flow.
Hood: Neoprene/rayon baffle to impede air flow above coil.
- K. Operation - Provide 1/2 HP, 115V, 1-phase, 6.8-amp Model SG continuous Duty motor operator with MW wall mount on the side opposite the man door, surface mounted. Provide 3 position (open, close and stop) key switch with automatic screw type limit switch. Key switch shall accept Best cylinder as specified in Section 08 71 00 - Finish Hardware to be keyed to the district standard. Provide 2 wire E.L.R. electric sensing edge / weather seal. Provide emergency manual chain operation.
- L. Refer to Section 08 71 00 – Door Hardware for door hardware, key switches and lock requirements. Coordinate with other trades as required.

2.3 ACCESSORIES

- A. Locking: Manual Chain Hoist: Padlockable chain keeper on guide.
- B. Operator Cover: Provide 24-gauge galvanized steel sheet metal cover to provide weather resistance coil area of unit. Finish to match door hood.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and interfacing assemblies upon which Work will be installed and verify conditions are in accordance proper installation of this Work.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of Work by installer is acceptance of substrate.

3.2 INSTALLATION

- A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
- B. Follow manufacturer's installation instructions.
- C. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.3 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.4 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 56 19

INTERIOR TRANSACTION WINDOWS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Self-closing sliding transaction windows.
- C. Related Work:
 - 01 Section 08 11 16 – Aluminum Door and Glazing Frames
 - 02 Section 08 71 00 – Door Hardware
 - 03 Section 08 80 00 – Glazing

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Operations and Maintenance Manuals:
 - 01 Provide complete operations and maintenance manuals to the Owner.

- 02 Refer to section 01 78 23 – Operations and Maintenance Manuals
- 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).

G. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 01 ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
- B. American Society for Testing and Materials (ASTM):
 - 01 ASTM A 36/A 36M. - Standard Specification for Carbon Structural Steel.
 - 02 ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
 - 03 ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 04 ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 05 ASTM B221/B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 06 ASTM C1036 - Standard Specification for Flat Glass.
 - 07 ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 08 ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 09 ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
 - 10 ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance.
 - 11 ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 12 ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 - 13 ASTM F588 - Standard Test Methods for Resistance of Window Assemblies to Forced Entry Excluding Glazing.
 - 14 ASTM F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- C. American Architectural Manufacturers Association:
 - 01 AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 - 02 AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
- D. American Society Mechanical Engineers Standards:
 - 01 ASME SA-240/SA-240M - Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- E. National Fire Protection Association (NFPA):

- 01 NFPA 80 – Fire Doors and Windows.
- 02 NFPA 252 – Fire Tests of Door Assemblies.
- 03 NFPA 257 – Fire Tests of Window Assemblies.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Provide aluminum framing systems and windows from one source and supplied by a single manufacturer.
- C. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in:
 - 01 Flat Glass Marketing Association:
 - a. Glazing Sealing Systems Manual.
 - b. Glazing Manual.

1.5 WARRANTY

- A. Warranty the Work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials and workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 01 Operational issues that preclude smooth operation and functioning
 - 02 Noticeable deterioration of finish.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of special function windows is based on products manufactured by QuickServ Corp.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 C.R. Lawrence

2.2 PERFORMANCE SPECIFICATIONS

- A. Requirements apply simultaneously through the most adverse conditions of each exterior application.
 - 01 Thermal Movement at Exterior Systems: Provide for noiseless expansion and contraction of all materials and assemblies due to temperature changes in a range between 10°F and 180°F, without detriment to appearance or performance.
 - 02 Water Infiltration at Exterior Systems: Drain water entering at joints and condensation occurring within the wall construction to the exterior face of the wall. Allow no uncontrolled water other than condensation on the interior face of the wall.

- 03 Air Filtration at Exterior Locations: Limit air leakage to maximum 0.005 CFM/SF at 6.24 PSF.

2.3 GENERAL MATERIALS

- A. Aluminum Extrusions: ASTM B221/B221M. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength and not less than 0.125 inch thick at any location for main frame and sash members.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Metallic-Coated Steel Sheet:
 - 01 ASTM A653/A653M, CS (Commercial Steel), Type B; with G90 (Z275) zinc (galvanized) coating designation.
 - 02 AMS5511, steel, corrosion-resistant, sheet, strip, and plate, 19Cr - 9.5Ni (304L), solution heat treated.
 - 03 AMS5513, steel, corrosion-resistant, sheet, strip, and plate 19cr 9.2Ni (SAE 30304) solution heat treated.
- D. Stainless Steel Sheet, Strip, Plate, and Flat Bars:
 - 01 ASTM A666, austenitic stainless steel, Type 304, stretcher-leveled standard of flatness.
 - 02 ASME SA-240/SA-240M, chromium and chromium-nickel stainless steel plate, sheet, and strip for general applications.
- E. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.
- F. Embedded Plate Anchors: Fabricated from steel shapes and plates, minimum 3/16 inch (4.8 mm) thick; with minimum 1/2-inch- (12.7-mm-) diameter, headed studs welded to back of plate.
- G. Welding Rods and Bare Electrodes: Select according to AWS Specifications for metal alloy welded.
- H. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement.
 - 01 Sealant shall remain permanently elastic, non-shrinking, and non-migrating.
- I. Gaskets: For gaskets required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Gaskets shall remain permanently elastic, non-shrinking, and non-migrating.
- J. Inserts and Anchorage Devices:
 - 01 Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
 - 02 Provide all anchoring angles, plates, fasteners and accessories required for secure attachment to adjacent Work.
- K. Fasteners:
 - 01 Non-magnetic stainless steel or cadmium plated steel coated with yellow or silver iridescence plating, compatible with materials being fastened.
 - 02 Provide series 300 stainless steel for exposed locations.

- 03 Provide cadmium plated steel with 0.0005 inch plating thickness and color chromate coated for concealed locations.
- 04 Provide concealed fasteners wherever possible.
- 05 For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.
- 06 Finish of sub-sill flashing shall match frame finish.

L. Miscellaneous Materials:

- 01 Provide material isolators at all dissimilar metals in contact with aluminum framing components.

2.4 SLIDING TRANSACTION WINDOW

- A. Design of sliding transaction windows is based on QuickServ Self-Closing (SC) series manual sliding window.
- B. Nominal Size:
 - 01 Custom size as indicated on the Drawings.
- C. Frames: Nominal 4-1/2" aluminum frame modules shall be constructed of 6063-T5 extruded aluminum.
 - 01 Replacement and servicing of glass shall be from the clerk side of the window by means of an access panel in the top header and does not require the removal of the frame from the opening.
- D. Glass Type G-2: Fully Tempered Clear Glass:
 - 01 1/4" thick.
 - 02 Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - 03 Clear.
- E. Operation:
 - 01 Self-closing with hold open feature
 - 02 Track System: Top-hung ball bearing system providing smooth operation of operable window.
- F. Provide keyed lock.
- G. Finish:
 - 01 Dark Bronze

PART 3 - EXECUTION

3.1 PREPARATION

- A. Windows are designed to be mounted with a cased opening of a larger aluminum and glass window system.
- B. Coordinate with glazing contractor as required to provide rough opening as required for proper installation of, and interface with transaction window; including anchoring of transaction window.

3.2 INSTALLATION

- A. Install all transaction windows in strict accordance with the manufacturer's installation standards and recommendations.
- B. Upon completion of installation, thoroughly test all functions of the window to verify proper operation.

3.3 PROTECTION

- A. Protect all windows during and after installation from marring, blemishes, scratches and damage due to incidental adjacent Work.
- B. If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Furnish finish door hardware as scheduled and specified.
- C. Related Work:
 - 01 Section 08 11 13 Hollow Metal Doors & Frames
 - 02 Section 08 14 23.16 – Plastic Laminate Faced Wood Doors
 - 03 Section 08 80 00 – Glazing

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Shop drawings. Schedule the specified hardware sets correlated to the door numbers shown on the Drawings. Submit data sheets of the items proposed for use.
- C. Templates: As soon as schedules are returned, without exception, furnish required template information to the various manufacturers for fabrication purposes.
- D. Upon completion, deliver to Owner two (2) copies of approved finish hardware schedule and keying schedule together with one set of clearly marked installation tools and templates.

1.3 QUALITY ASSURANCE

- A. Installer. Finish hardware installer shall be a person or firm technically proficient and experienced in this trade and shall be responsible for properly detailing and fitting materials to the condition required by the Drawings.
- B. Fire Rated Openings. Provide hardware which complies with NFPA80 and which has been tested and listed by UL or FM for the use indicated.
- C. Standards for Handicapped. Comply with Section 7, Article 601b, Vernon's Texas Civil Statutes.

1.4 WARRANTY

- A. Provide two (2) years warranty against defects in materials and workmanship commencing with substantial completion of the project.
- B. Defects shall include, but not be limited to the following:
 - 01 Faulty or inadequate design.
 - 02 Improper fabrications or assembly.
 - 03 Defective finishes.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURES

A.	Item	Specified Manufacturer	Approved Manufacturers
	Hinges		
	Pivots		
	Locksets		
	Cylinder		
	Cylinder Cores		
	Magnetic Locks		
	Exit Devices		
	Closers		
	O.H. Stops		
	Pulls/Push		
	Flushbolts		
	Stops		
	Kickplates		
	Thresholds		
	Gasketing		
	Door Bottoms		

2.2 GENERAL

- A. Package each item of hardware separately. Mark each package with item number corresponding to item number shown in the hardware schedule.
- B. Keying: [Typical]
 - 01 Furnish cylinders with construction cores or construction master keyed, as applicable for lock type specified.
 - 02 Confer with Owner for precise keying requirements.
 - 03 Furnish three (3) keys each set.
 - 04 Visual Key Control: Stamp keys and cores with key set symbol.
 - 05 Master key and grand master key as directed.
 - 06 Provide cylinder keyed dogging for all panic exit devices.

2.3 HARDWARE SCHEDULE

HARDWARE SET # 01 Main Glass Entry Door

Door 500

Mag-Lock

Following hardware provided by glass door supplier.

Bottom Adjustable Pivot Hinge

Top Pivot / Closer Insert

Overhead Concealed Closer with Hold Open

HARDWARE SET # 02 Glass Doors - Offices

Doors	506	507	508	509	510	520	535	536	537
	540	541							

Cylinder / Core (only) 1 Each Sargent

Following hardware provided by glass door supplier.

Bottom Adjustable Pivot Hinge

Top Pivot / Closer Insert

Overhead Concealed Closer with Hold Open

HARDWARE SET # 03 Glass Doors - Conference Room

Doors	504	505	530
-------	-----	-----	-----

All hardware provided by glass door supplier.

Bottom Adjustable Pivot Hinge

Top Pivot / Closer Insert

Overhead Concealed Closer with Hold Open

HARDWARE SET # 04 Office Doors

Doors	513	521	523	524	525	526	545
-------	-----	-----	-----	-----	-----	-----	-----

Hinges 3 Each

Lockset (office function) 1 Each

Wall Stop 1 Each

HARDWARE SET # 05 Passage (push / pull only)

Doors	544	546A
-------	-----	------

Hinges 3 Each

Push / Pull 1 Each

Wall Stop 1 Each

HARDWARE SET # 06 Passage (push / pull only)

Door	517A
------	------

Hinges 4 Each

Push / Pull 1 Each

Wall Stop 1 Each

HARDWARE SET # 07 Access Controlled

Doors	500A	540
-------	------	-----

Hinges 3 Each

Electronic Lockset 1 Each

Closer

Wall Stop 1 Each

Doors	517
-------	-----

PART 3 - EXECUTION

3.1 COORDINATION

- A. Prepare a complete schedule, including all items proposed for each opening and other miscellaneous items. Submit four (4) copies to the Architect for approval before purchase of the material.
- B. Prior to the final inspection by the Architect, the supplier shall check all closers for proper operation after they have been installed and adjusted by the Contractor, and he shall make necessary adjustments to those closers, which prove to be difficult to adjust upon the initial attempt of the Contractor. He shall verify the keying to ensure proper locations of locksets and shall assist the Contractor in correcting faulty operation of any lock called to his attention by the Contractor.
- C. Supplier shall attend and chair a keying meeting with the Owner, Architect and Contractor, once submittals have been reviewed.
- D. Marking and Delivery: Mark each item of hardware for opening on which it is to be used and deliver a complete schedule to the Contractor when the hardware is delivered. Should the marking of any item become separated from the item after delivery, the item will be returned to the supplier by the Contractor for remarking, before attempting to install it.
- E. Master keys shall be hand delivered to the Owner by the hardware supplier within twenty-four (24) hours upon notification by the Architect.

END OF SECTION

SECTION 08 80 00

GLAZING & ALUMINUM FRAMES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Exterior glass and aluminum framing systems and storefront systems.
 - 02 Interior glass and aluminum framing systems and storefront systems.
 - 03 Glazing of plastic laminate doors.
 - 04 Glazing of hollow metal doors.
- C. Related Work:
 - 01 Section 06 10 00 – Rough and Finish Carpentry
 - 02 Section 08 11 13 – Hollow Metal Doors and Frames
 - 03 Section 08 14 23.16 – Plastic Laminate Faced Wood Doors
 - 04 Section 08 56 19 – Interior Transaction Windows
 - 05 Section 08 71 00 – Door Hardware
 - 06 Section 08 87 23 – Security and Safety Film

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.

- 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Design Calculations: Provide engineering calculations, signed and sealed by a Texas Registered Structural Engineer, which demonstrate the design, assemblies and anchoring of proposed glazing assemblies meet or exceed the stated wind load requirements for all conditions.
- G. Samples: Show manufacturer's full range of colors:
- 01 Samples of each type of glass (12" x 12" minimum).
 - 02 In place sample of sealant at frame perimeter for Architect's approval. Architect shall select samples for review from manufacturer's full color line.
 - 03 Obtain hardware templates from finish hardware supplier.
 - 04 Samples of framing finish for approval and fastener types.
 - 05 Sample of proposed sub-sill flashing; minimum 12" in length, complete with end dams on both ends.
- H. Mock-up:
- 01 In conjunction with mock-up wall required for masonry and back-up walls, provide a mock-up window incorporated into the masonry mock-up.
 - 02 Mock-up window shall be minimum 16" x 16" and shall include head, jamb, sill framing members and sub-sill flashing. Glass is not required.
 - 03 Construct in such a way that all fastening methods are viewable.
 - 04 Perimeter of window shall be sealed continuous.
- I. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
- 01 ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
- B. American Society for Testing and Materials (ASTM):
- 01 ASTM C162 – Standard Terminology for Glass and Glass Products.
 - 02 ASTM E 774 – Standard Specification for Sealed Insulating Glass Units.
 - 03 ASTM C920 Standard Specification for Elastomeric Joint Sealants.
 - 04 ASTM C1036 – Standard Specifications for Flat Glass.
 - 05 ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
 - 06 ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
 - 07 ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Door
 - 08 ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
 - 09 ASTM E1300 - Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
 - 10 ASTM E2010-01 – Standard Test Methods for Positive Pressure Fire Tests for Window Assemblies.

- 11 ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance.
 - 12 ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 13 ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.
- C. American Architectural Manufacturers Association (AAMA)
- 01 AAMA 502 – Specification for Field Testing of Newly Installed Fenestration Products.
 - 02 AAMA 503 – Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
- D. Federal Specifications:
- 01 Fed. Spec. DD-G-001403 B.
 - 02 Fed. Spec. TT-S-00230 Sealing Compound: Synthetic Rubber Base and TT-S-00203C.
 - 03 Fed. Spec. TT-S-001657 Sealing Compound: Butyl Rubber Base.
 - 04 Fed. Spec. DD-G-451d.
- E. National Fire Protection Association (NFPA):
- 01 NFPA 80 – Fire Doors and Windows.
 - 02 NFPA 252 – Fire Tests of Door Assemblies.
 - 03 NFPA 257 – Fire Tests of Window Assemblies.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Provide aluminum framing systems, doors, and windows from one source and supplied by a single manufacturer.
- C. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in:
 - 01 Flat Glass Marketing Association:
 - a. Glazing Sealing Systems Manual.
 - b. Glazing Manual.
- D. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- E. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00, classified and labeled by UL acceptable to authorities having jurisdiction.
- F. Field Testing:
 - 01 Water penetration and air infiltration field testing shall be performed by the Materials & Testing Laboratory or by a third-party building envelope testing consultant under separate contract with the Owner.
 - 02 Testing of three (3) different locations shall be performed at the following intervals of the glazing installation: 10% complete, 50% complete and 90% complete.

- 03 Specific test locations shall be determined on the day of the testing; and may include both first and second floor locations.
- 04 Refer to Part 3 – Execution for additional information.

G. Manufacturer's Field Representation:

- 01 The manufacturer shall provide on-site observation by a qualified technical representative familiar with the window systems being installed at the following times:
 - a. Commencement of Window Installation: Representative shall observe the complete installation of the first window being installed.
 - b. Field Testing: Representative shall be present for all field testing of windows and glazing.
 - c. Periodic site observation visits during window / glazing installation at the following intervals of installation completeness: 25%, 50%, 75% and 100%.
- 02 Within seventy-two (72) hours after each site observation visit, the manufacturer's representative shall furnish an observation report documenting activities, direction to the installer, and other pertinent information.

1.5 WARRANTY

- A. Submit a written warranty, executed by the entrance manufacturer, agreeing to repair or replace units that fail in workmanship for a period of five (5) years from date of Substantial Completion. Failures include, but are not limited to:
 - 01 Structural and performance failures, including excessive deflection, excessive leakage, air infiltration beyond specified requirements.
 - 02 Faulty operation of hardware directly related to items listed above.
 - 03 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The design of aluminum framing systems, storefronts and doors is based on materials / systems / assemblies as manufactured by Oldcastle Building Envelope.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided all proposed products meet or exceed the specified requirements.
 - 01 Kawneer North America
 - 02 Tubelite Glass & Aluminum Solutions
 - 03 YKK AP American, Inc.
 - 04 EFCO
- C. Glass: The following manufacturers are acceptable to provide glass products in accordance with the specified requirements:
 - 01 Vitro (Formerly PPG Industries) Basis of Design
 - 02 AGC Flat Glass North America, Inc. (formerly AFG Industries)
 - 03 HGP Industries, L.L.C.
 - 04 Oldcastle Building Envelope
 - 05 TGP Architectural

2.2 PERFORMANCE SPECIFICATIONS

- A. Requirements apply simultaneously through the most adverse conditions of each exterior application.
 - 01 Thermal Movement at Exterior Systems: Provide for noiseless expansion and contraction of all materials and assemblies due to temperature changes in a range between 10°F and 180°F, without detriment to appearance or performance.
 - 02 Water Infiltration at Exterior Systems: Drain water entering at joints and condensation occurring within the wall construction to the exterior face of the wall. Allow no uncontrolled water other than condensation on the interior face of the wall.
 - 03 Air Filtration at Exterior Locations: Limit air leakage to maximum 0.005 CFM/SF at 6.24 PSF.

2.3 GENERAL MATERIALS

- A. Aluminum:
 - 01 ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
 - 02 Provide minimum thickness of 0.125 inch for framing members and 0.050 inch for glazing stops and similar components.
- B. Internal Reinforcing:
 - 01 ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
 - 02 Shapes and sizes to suit installation.
 - 03 Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with Federal Spec. TT-P-645.
 - 04 Provide steel reinforcing in aluminum framing as required to achieve specified wind load resistance.
- C. Inserts and Anchorage Devices:
 - 01 Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
 - 02 Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
 - 03 Provide all anchoring angles, plates, fasteners and accessories required for secure attachment to adjacent work.
- D. Fasteners:
 - 01 Type 304 or 316 stainless steel for fastening into treated wood.
 - 02 Type 304 or 316 stainless steel for exposed locations.
 - 03 Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.
 - 04 Provide concealed fasteners wherever possible.
 - 05 For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.
 - 06 All fasteners used to secure the sub-sill flashing and sill frame member shall be bedded in sealant at penetrations through window assembly components. Heads of fasteners at these locations shall be covered with sealant.
- E. Sub-Sill Flashing:

- 01 All exterior glazed systems / window walls / windows shall be furnished with continuous sub-sill flashing, spanning the full width of the rough opening.
 - 02 Sub-sill flashing shall be minimum 0.065" aluminum with integral (turned up) end dams and back dams. Minimum height of dams shall be 1".
 - 03 Open vertical joint at end dam / back dam junction shall be welded continuous to form a seamless dam component directing any / all trapped water to outside of building. Provide thicker material than specified above if required to meet this requirement.
 - 04 Sub-sill flashing shall extend to the exterior building face / veneer and turn down 3/4".
 - 05 All exposed edges shall be ground to eliminate sharp edges and corners. Hemmed edges are acceptable.
 - 06 Finish of sub-sill flashing shall match frame finish.
- F. Miscellaneous Materials:
- 01 Provide material isolators at all dissimilar metals in contact with aluminum framing components.
 - 02 Where indicated on the Drawings provide minimum 0.080" aluminum extrusions or break metal between non-contiguous framing components (i.e. segmented radius walls, column wraps, etc.). Fabricate as required for concealed fastening.
- G. Glazing Materials at Aluminum Framing:
- 01 Glazing Gaskets: Extruded neoprene conforming to ASTM C502 (color "black"), sized to fit the frame.
 - 02 Sealant: Comply with Federal Spec. TT-S-00230.
- H. Glazing Materials at Hollow Metal Frames:
- 01 General: Use glazing compound and preformed glazing sealants approved for the application, except as otherwise specified, conforming to Glazing Materials portion of the FGMA Glazing Manual.
 - 02 Sealant:
 - a. One part acrylic polymer sealant conforming to Federal Spec. TT-S-00230 or silicone, Federal Spec. TT-S-0023-C. Use for glazing of all fixed glass. Include primer as recommended by manufacturer.
 - b. Color: Shall as selected by Architect from manufacturer's full range.
 - c. All sealants shall be compatible with adjacent material per manufacturer's recommendations and instructions.
 - 03 Setting Blocks: Hard rubber or clean grain softwood.
 - 04 Back-up Material: Foamed polyethylene or polystyrene rod stock; sizes as required by joint condition, and compatible with sealant.
 - 05 Glazing Tape: DAP #1202 or as approved.
 - 06 Glazing Gaskets: Extruded neoprene, free of porosity, surface defects, dimensional irregularities, and conforming to physical properties of ASTM C502.
 - 07 Use of metal sash putty will not be permitted, but compound conforming to Federal Spec. T-G-410 will be permitted. The use of non-skinning compounds, non-resilient type preformed sealers and preformed impregnated type gaskets will not be permitted.

2.4 GLASS MATERIALS

- A. Glass Type G-1: Insulated Fire Rated Glass:

- 01 Design is based on TPG FireLite IGU series.
 - 02 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.
 - 03 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
 - 04 Exterior / Outboard Lite shall be:
 - a. Fully Tempered Tinted Glass.
 - b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall match other adjacent TISD school projects on larger site. Solarban 67(2) Optigray
 - 05 Interior / Inboard Lite shall be:
 - a. Clear FireLite Plus Glass with Premium surface finish.
 - b. Complying with Impact Safety Rating: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - c. Clear.
- B. Glass Type G-2: Fully Tempered Clear Glass:
- 01 1/4" thick.
 - 02 Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - 03 Clear.
 - 04 Use at all non-fire-rated interior glazing unless indicated otherwise.
- C. Glass Type G-3: Fire-Rated Safety Wired Glass: **(NOT Used)**
- 01 1/4" thick clear with fire-rated surface film.
 - 02 Provide fire-rating of 20 minutes to 90 minutes for doors and 20 minute to 45 minute for other applications.
 - 03 Complying with ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - 04 Wire pattern shall be straight diamond mesh or square grid, as selected by Architect.
- D. Glass Type G-4: Insulated Glass:
- 01 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.
 - 02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
 - 03 Exterior / Outboard Lite shall be:
 - a. Fully Tempered Tinted Glass.
 - b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall match other adjacent TISD school projects on larger site. Solarban 67(2) Optigray
 - 04 Interior / Inboard Lite shall be:
 - a. Fully tempered glass.
 - b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - c. Clear.
- E. Glass Type G-5: Insulated Spandrel Glass:
- 01 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.
 - 02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
 - 03 Exterior / Outboard Lite shall be:
 - a. Fully Tempered Tinted Glass.

- b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall match other adjacent TISD school projects on larger site. Solarban 67(2) Optigray
 - d. Ceramic Enamel Frit: color as selected by Architect from manufacturer's full range of available colors / finishes.
 - 04 Interior / Inboard Lite shall be:
 - a. Fully tempered glass.
 - b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - c. Clear.
- F. Glass Type G-6: Acoustical Glass:
 - 01 Overall thickness of nominal 1" comprised of one lite of 1/4" clear laminated safety glass and one lite of 3/8" clear laminated safety glass separated by a nominal 3/8" air space.
 - 02 Laminating interlayer materials shall be Polyvinyl Butyral (PVB) sheet; .020" minimum.
 - 03 Dual sealed with a primary seal of polyisobutylene (PIB) and a secondary seal of silicone or organic sealant as recommended by the manufacturer for the specific application.
 - 04 Minimum STC Rating: 48
 - 05 Install in sound control door assemblies provided in Section 08 34 73 – Sound Control Door Assemblies; and window assemblies where indicated on the Drawings.
- G. Glass Type G-7: Safety And Security Glass:
 - 01 1/4" thick.
 - 02 Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - 03 Clear.
 - 04 All Glass to have security film and applicable sealant applied. Re: Specification 08 87 23
- H. Glass Type G-8 – Safety And Security Glass:
 - 01 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.
 - 02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
 - 03 Exterior / Outboard Lite shall be:
 - a. Fully Tempered Tinted Glass.
 - b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall match other adjacent TISD school projects on larger site. Solarban 67(2) Optigray
 - 04 Interior / Inboard Lite shall be:
 - a. Fully tempered glass.
 - b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - c. Clear.
 - 05 All Glazing to have security film and applicable sealant applied on interior. Re: Specification 08 87 23

2.5 EXTERIOR ALUMINUM STOREFRONT DOORS

- A. Exterior Aluminum Entrance Doors: design is based on Oldcastle "Rugged" WS Wide Stile door unit assembly.
 - 01 Nominal depth: 2", fabricated with 0.188" minimum thickness aluminum at all tubular sections.
 - 02 Vertical Stiles: 5".
 - 03 Top Rail: 5-3/4".
 - 04 Bottom Rail: 10".
 - 05 Standard Structural Shapes, Rolled or Extruded Aluminum: Alloy 6061-T6.
 - 06 Connections: Provide bolted and welded connections, fit to a hairline joint.
 - 07 Provide reinforcing at bolted attachments. Tapped aluminum is not permitted.
 - 08 Provide concealed screws, nuts, bolts, and anchors, except hardware screws on hinge and closer-arm of door, of non-corrosive metal.
 - 09 Finish: Dark bronze anodized aluminum.
 - 10 Glass in Exterior Doors: Type G-4 at all exterior locations.
 - 11 Use manufacturer's recommended gaskets for flush glazing (color "black").
 - 12 Refer to Section 08 71 00 – Door Hardware for finish hardware requirements. Coordinate with other trades as required.

2.6 EXTERIOR ALUMINUM FRAMING SYSTEMS

- A. Aluminum Storefront / Entrance Framing System: Basis of design is Oldcastle Series ICR-225.
 - 01 Size: 2-1/4" x 6" mullion profile - front set, exterior loaded; available with butt glazed verticals; to accept 1" glazing.
 - 01 Pressure glazed, front set, exterior loaded; available with butt glazed verticals.
 - 02 Provide sub-frames at door head / jambs on entrances as required to accept Rugged WS doors.
 - 03 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet wind load criteria.
 - 04 Intermediate horizontal mullions shall be undersized to 4-1/2" depth.
 - 05 Finish: Dark bronze anodized aluminum.
 - 06 Glass: Type G-4 at all exterior locations. Provide glass Type G-5 where indicated.
 - 07 Glass pockets shall be sized to accept glass specified.
 - 08 Provide continuous, full depth sill flashing with end dams at all sill sections.

2.7 INTERIOR ALUMINUM FRAMING SYSTEMS

- A. Aluminum Framed Systems: design is based on Oldcastle FG-2000 Flush Glazed Storefront system:
 - 01 Size: 1-3/4" x 4-1/2" mullion profile; center set, exterior loaded; to accept 1/4" glazing.
 - 02 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet loading criteria.
 - 03 Finish: Dark bronze anodized aluminum.
 - 04 Glass: Type G-2.
 - 05 Glass pockets shall be sized to accept glass specified.

- B. Interior Aluminum Entrance Doors: design is based on Oldcastle Series 500 Wide Stile door unit assembly.
- 01 Nominal depth: 1-3/4", fabricated with 0.125" minimum thickness aluminum at all tubular sections.
 - 02 Vertical Stiles: 5-1/2".
 - 03 Top Rail: 4-1/2".
 - 04 Bottom Rail: 8-1/2".
 - 05 Standard Structural Shapes, Rolled or Extruded Aluminum: Alloy 6063-T5.
 - 06 Provide concealed screws, nuts, bolts, and anchors, except hardware screws on hinge and closer-arm of door, of non-corrosive metal.
 - 07 Finish: Dark Bronze aluminum.
 - 08 Glass: Type G-2 at all interior locations.
 - 09 Use manufacturer's recommended gaskets for flush glazing (color "black").
 - 10 Refer to Section 08 71 00 – Door Hardware for finish hardware requirements. Coordinate with other trades as required.

2.8 SOLAR CONTROL DEVICES

- A. Design of solar control devices is based on Oldcastle Solar Eclipse sunshade; "Airfoil" (large) Series aluminum sunshade.
- B. Solar control devices shall be specifically engineered and fabricated for use specifically with the Oldcastle Reliance framing system.
- 01 Projected depth: 36".
 - 02 Width: As required to fit parent window / opening frame.
 - 03 Design to meet all structural and required wind loads.
- C. Solar control devices shall be complete assemblies; comprised of brackets, anchors, outriggers, louvers and fascia that are anchored directly to the Aluminum framing vertical members.
- D. Finish: Clear anodized aluminum finish, all parts.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Thoroughly examine conditions at each and every location under which Work of this Section will be performed.
- 01 Verify that each rough opening is the correct size for the framing being installed. Maximum allowable joint at perimeter of framing shall be 5/8". Inform General Contractor of any non-conforming rough openings and do not proceed until unsatisfactory conditions are corrected.
 - 02 Verify that the sub-sill substrate is continuous, solid, level and at the proper elevation for installation of sub-sill flashing. Sub-sill flashing must be set in a 100% bed of sealant without any voids. Do not proceed until unsatisfactory conditions are corrected.
- B. Verify that wood blocking, thru-wall flashing, masonry and other adjacent work is installed as required for the proper installation of aluminum framing prior to proceeding. Inform General Contractor of any non-conforming work and do not proceed until unsatisfactory conditions are corrected.

- C. Clean glazing channels, stops, and rabbets to receive the glazing materials, making free from obstructions and deleterious substances which might impair the work.
 - 01 Remove protective coatings which fail in adhesion or interfere with bond of sealants.
 - 02 Comply with manufacturer's instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes.
 - 03 Prime surfaces to receive glazing compounds in accordance with manufacturer's recommendations.

3.2 INSTALLATION – ALUMINUM FRAMING

- A. Install all aluminum framing in strict accordance with the manufacturer's installation standards and recommendations; firmly anchored for long life under hard use.
- B. All exterior sill members shall be installed with continuous aluminum sub-sill flashing.
 - 01 Set sub-sill flashing in 100% bed of sealant. Carefully clean off excess sealant after sub-sill flashing is set in place.
 - 02 All fasteners used to anchor sub-sill flashing shall be completely bedded in sealant prior to installation of sill framing.
 - 03 All fasteners securing sill framing which penetrates through sub-sill flashing shall be installed through a sealant bed as required to maintain the waterproof integrity of the sub-sill flashing / sill-framing assembly.
 - 04 Coordinate with dampproofing sub-contractor to install additional thru-wall flashing at base of jambs to lap over / onto aluminum sub-sill flashing – prior to installation of aluminum framing member(s). Coordinate as required.
- C. Shim and center framing within rough opening. Maximum sealant joint at perimeter of framing shall be 5/8". Coordinate with other trades to correct rough opening where perimeter joint will exceed 5/8".
- D. Erection Tolerances:
 - 01 Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.
 - 02 Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.
 - 03 Maximum Deviation from True Alignment: 1/32 inch from any two abutting units; and horizontal components meeting at a vertical mullion. Allow no edge projections.
 - 04 Maximum Joint Cap: 1/32 inch.
 - 05 Maximum Openings Between Movable Glazing Stop and Adjacent Member: 1/32 inch.

3.3 INSTALLATION – GLASS

- A. Inspect each piece of glass immediately prior to start of installation.
 - 01 Do not install items which are improperly sized, have damaged edges, are scratched, abraded, or damaged in any other manner.
 - 02 Do not remove labels from glass until so directed by the Architect.
 - 03 Install glass so distortion waves, if present, run in a horizontal direction.
- B. Locate setting blocks at sills one quarter of the width of the glass in from each end of the glass, unless otherwise recommended by the glass manufacturer.

- 01 Use blocks of proper size to support the glass in accordance with the manufacturer's recommendations.
- 02 Provide spacers for all glass sizes larger than 50 united inches, to separate glass from stops, except where continuous glazing gaskets or felts are provided.
 - a. Locate spacers no more than 24 inches apart, and no closer than 12 inches to a corner.
 - b. Place spacers opposite one another.
 - c. Make bite of spacer on glass 1/4 inch or more.
- C. Set glass in a manner which produces the greatest possible degree of uniformity in appearance.
- D. Do not use two different glazing materials in the same joint system, unless the joint use is approved in advance by the Architect.
- E. Mask, or otherwise protect surfaces adjacent to installation or sealants.
- F. Install all glass, gasket and aluminum framing in strict accordance with manufacturer's printed instructions.
- G. Caulk joints continuous at exterior and interior faces of framing and elsewhere as indicated, as required to meet performance specifications using materials specified in Section 07 92 00 – Joint Sealants. Follow sealant manufacturer's printed instructions for the installation of his product.

3.4 FIELD TESTING

- A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
 - 01 Interior finishes at window recess (i.e. gypsum board, window sill) shall not be installed at window units to be tested.
 - 02 If interior finishes at window recess have been installed at windows to be tested, they shall be removed by Contractor prior to testing; and then reinstalled at no additional cost to the Owner.
- B. Manufacturer's representative shall be present to observe all field tests and retests.
- C. Testing:
 - 01 Testing shall be performed per AAMA 503 by a qualified independent testing agency.
 - 02 Air Infiltration Tests: Conduct tests in accordance with ASTM E 783.
 - a. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft², whichever is greater.
 - 03 Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105.
 - a. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 PSF.
- D. Failed Tests:
 - 01 Tests not meeting specified performance requirements and units having deficiencies shall be corrected by the Contractor and the failed window unit / area shall be retested.

- 02 In addition to retesting the failed window unit / area, an additional two (2) similar window units / areas shall be tested.
- 03 All retesting and testing caused by a failed test shall be at the expense of the Contractor.

3.5 PROTECTION

- A. Protect glass from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass.
 - 01 Do not apply warning markings, streamers, ribbons, or other items directly to the glass, except as specifically directed by the Architect.
- B. Protect all window framing during and after installation from marring, blemishes, scratches and damage due to incidental adjacent work.
 - 01 If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

END OF SECTION

SECTION 08 80 00

GLAZING

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

- 1.1 DESCRIPTION** *Specifier: Coordinate this paragraph with your project requirements.*
IF project is CSP – use this A.
- A. Refer to Section AB – Instructions to Proposers, Section AF – Subcontractor / Manufacturer Prequalification, and Section 01 25 00 – Request for Substitution Procedures.
IF project is CM@R – replace A with the following:
Refer to Section 01 25 00 – Request for Substitution Procedures.
- IF project is CSP – delete this B.*
IF project is CM@R - Find out if proposal instructions are provided or NOT provided.)
- B. Refer to the CM@R Proposal Instructions. (Issued under separate cover.)
- IF project is NOT in "Hurricane" zone – delete this C.*
- C. This project is in the TWIA Zone: Inland I and building envelope components shall meet the requirements for certification / approval of Texas Department of Insurance. (TDI.)
- Tailor to your project specific information.*
- D. Scope of Work:
- 01 Exterior glass and aluminum framing systems and storefront systems.
 - 02 Interior glass and aluminum framing systems and storefront systems.
 - 03 Glazing of plastic laminate doors.
 - 04 Glazing of hollow metal doors.
 - 05 Unframed mirrors
 - 06 Glass doors at job built display cases
- Tailor to your project specific information.*
- E. Related Work:
- 01 Section 06 10 00 – Rough Carpentry
 - 02 Section 08 11 13 – Hollow Metal Doors and Frames
 - 03 Section 08 11 16 – Aluminum Door and Glazing Frames
 - 04 Section 08 14 23.16 – Plastic Laminate Faced Wood Doors
 - 05 Section 08 56 19 – Interior Transoms Windows
 - 06 Section 08 56 23 – Security Windows
 - 07 Section 08 71 00 – Door Hardware
 - 08 Section 08 87 23 – Security and Safety Film
 - 09 Section 08 87 33 – Decorative Film

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.

- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
- 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Where required to meet TDI wind zone requirements, provide certified shop drawings and calculations signed and sealed by a Texas Registered Structural Engineer
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
- 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
- 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Design Calculations: Provide engineering calculations, signed and sealed by a Texas Registered Structural Engineer, which demonstrate the design, assemblies and anchoring of proposed glazing assemblies meet or exceed the stated wind load requirements for all conditions.
- G. Samples: Show manufacturer's full range of colors:
- 01 Samples of each type of glass (12" x 12" minimum).
 - 02 In place sample of sealant at frame perimeter for Architect's approval. Architect shall select samples for review from manufacturer's full color line.
 - 03 Obtain hardware templates from finish hardware supplier.
 - 04 Samples of framing finish for approval and fastener types.
 - 05 Sample of proposed sub-sill flashing; minimum 12" in length, complete with end dams on both ends.
- H. Mock-up:
- 01 In conjunction with mock-up wall required for masonry and back-up walls, provide a mock-up window incorporated into the masonry mock-up.
 - 02 Mock-up window shall be minimum 16" x 16" and shall include head, jamb, sill framing members and sub-sill flashing. Glass is not required.
 - 03 Construct in such a way that all fastening methods are viewable.
 - 04 Perimeter of window shall be sealed continuous.
- I. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. American National Standards Institute (ANSI):
 - 01 ANSI Z97.1 – American National Standard for Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
- B. American Society for Testing and Materials (ASTM):
 - 01 ASTM C162 – Standard Terminology for Glass and Glass Products.
 - 02 ASTM E 774 – Standard Specification for Sealed Insulating Glass Units.
 - 03 ASTM C920 Standard Specification for Elastomeric Joint Sealants.
 - 04 ASTM C1036 – Standard Specifications for Flat Glass.
 - 05 ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
 - 06 ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Glass.
 - 07 ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Door
 - 08 ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
 - 09 ASTM E1300 - Standard Practice for Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load.
 - 10 ASTM E2010-01 – Standard Test Methods for Positive Pressure Fire Tests for Window Assemblies.
 - 11 ASTM E2188 – Standard Test Method for Insulating Glass Unit Performance.
 - 12 ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 - 13 ASTM E2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.
- C. American Architectural Manufacturers Association (AAMA)
 - 01 AAMA 502 – Specification for Field Testing of Newly Installed Fenestration Products.
 - 02 AAMA 503 – Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.
- D. Federal Specifications:
 - 01 Fed. Spec. DD-G-001403 B.
 - 02 Fed. Spec. TT-S-00230 Sealing Compound: Synthetic Rubber Base and TT-S-00203C.
 - 03 Fed. Spec. TT-S-001657 Sealing Compound: Butyl Rubber Base.
 - 04 Fed. Spec. DD-G-451d.
- E. National Fire Protection Association (NFPA):
 - 01 NFPA 80 – Fire Doors and Windows.
 - 02 NFPA 252 – Fire Tests of Door Assemblies.
 - 03 NFPA 257 – Fire Tests of Window Assemblies.

1.4 QUALITY ASSURANCE

- A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the

specified requirements and the methods needed for proper performance of the work of this Section.

- B. Provide aluminum framing systems, doors, and windows from one source and supplied by a single manufacturer.
- C. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in:
 - 01 Flat Glass Marketing Association:
 - a. Glazing Sealing Systems Manual.
 - b. Glazing Manual.
- D. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- E. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E2074-00, classified and labeled by UL acceptable to authorities having jurisdiction.
- F. Field Testing:
 - 01 Water penetration and air infiltration field testing shall be performed by the Materials & Testing Laboratory or by a third-party building envelope testing consultant under separate contract with the Owner.
 - 02 Testing of three (3) different locations shall be performed at the following intervals of the glazing installation: 10% complete, 50% complete and 90% complete.
 - 03 Specific test locations shall be determined on the day of the testing; and may include both first and second floor locations.
 - 04 Refer to Part 3 – Execution for additional information.
- G. Manufacturer's Field Representation:
 - 01 The manufacturer shall provide on-site observation by a qualified technical representative familiar with the window systems being installed at the following times:
 - a. Commencement of Window Installation: Representative shall observe the complete installation of the first window being installed.
 - b. Field Testing: Representative shall be present for all field testing of windows and glazing.
 - c. Periodic site observation visits during window / glazing installation at the following intervals of installation completeness: 25%, 50%, 75% and 100%.
 - 02 Within seventy-two (72) hours after each site observation visit, the manufacturer's representative shall furnish an observation report documenting activities, direction to the installer, and other pertinent information.

1.5 WARRANTY

- A. Submit a written warranty, executed by the entrance manufacturer, agreeing to repair or replace units that fail in workmanship for a period of five (5) years from date of Substantial Completion. Failures include, but are not limited to:

- 01 Structural and performance failures, including excessive deflection, excessive leakage, air infiltration beyond specified requirements.
- 02 Faulty operation of hardware directly related to items listed above.
- 03 Deterioration of metals, metal finishes, and other materials beyond normal weathering.

If your project is in a TDI Windstorm Insurance Association zone, you must include the following paragraph – MODIFIED to fit your specific project.

1.6 WIND LOAD REQUIREMENTS

- A. All exterior aluminum and glass window walls, windows, storefront systems, and entrance units shall meet the requirements for certification / approval of Texas Department of Insurance (TDI).
- B. Wind Load Requirements:
 - 01 TWIA Zone: Inland I (with modified wind speed).
 - 02 Exposure: C.
 - 03 Importance Factor: 1.15.
 - 04 Wind Speed: 125 MPH, 3 second gusts.
- C. Framing, glazing, doors and hardware, including installation requirements shall be provided in strict accordance with TDI requirements.
- D. Assemblies shall bear the TDI Certification label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The design of aluminum framing systems, storefronts and doors is based on materials / systems / assemblies as manufactured by Oldcastle Building Envelope.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided all proposed products meet or exceed the specified requirements.
 - 01 Kawneer North America
 - 02 Tubelite Glass & Aluminum Solutions
 - 03 YKK AP American, Inc.
 - 04 EFCO
- C. Glass: The following manufacturers are acceptable to provide glass products in accordance with the specified requirements:
 - 01 AGC Flat Glass North America, Inc. (formerly AFG Industries, Inc.)
 - 02 HGP Industries, LLC
 - 03 Oldcastle Building Envelope
 - 04 Vitro (formerly PPG Industries)
 - 05 TGP Architectural

2.2 PERFORMANCE SPECIFICATIONS

- A. Requirements apply simultaneously through the most adverse conditions of each exterior application.
 - 01 Thermal Movement at Exterior Systems: Provide for noiseless expansion and contraction of all materials and assemblies due to

- temperature changes in a range between 10°F and 180°F, without detriment to appearance or performance.
- 02 Water Infiltration at Exterior Systems: Drain water entering at joints and condensation occurring within the wall construction to the exterior face of the wall. Allow no uncontrolled water other than condensation on the interior face of the wall.
 - 03 Air Filtration at Exterior Locations: Limit air leakage to maximum 0.005 CFM/SF at 6.24 PSF.

2.3 GENERAL MATERIALS

- A. Aluminum:
 - 01 ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.
 - 02 Provide minimum thickness of 0.125 inch for framing members and 0.050 inch for glazing stops and similar components.
- B. Internal Reinforcing:
 - 01 ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
 - 02 Shapes and sizes to suit installation.
 - 03 Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with Federal Spec. TT-P-645.
 - 04 Provide steel reinforcing in aluminum framing as required to achieve specified wind load resistance.
- C. Inserts and Anchorage Devices:
 - 01 Manufacturer's standard formed or fabricated assemblies, steel or aluminum, of shapes, plates, bars or tubes.
 - 02 Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.
 - 03 Provide all anchoring angles, plates, fasteners and accessories required for secure attachment to adjacent work.
- D. Fasteners:
 - 01 Type 304 or 316 stainless steel for fastening into treated wood.
 - 02 Type 304 or 316 stainless steel for exposed locations.
 - 03 Provide nuts or washers of design having the means to prevent disengagement; deforming of fastener threads is not acceptable.
 - 04 Provide concealed fasteners wherever possible.
 - 05 For exposed locations, provide countersunk flathead fasteners with finish matching item fastened.
 - 06 All fasteners used to secure the sub-sill flashing and sill frame member shall be bedded in sealant at penetrations through window assembly components. Heads of fasteners at these locations shall be covered with sealant.
- E. Sub-Sill Flashing:
 - 01 All exterior glazed systems / window walls / windows shall be furnished with continuous sub-sill flashing, spanning the full width of the rough opening.
 - 02 Sub-sill flashing shall be minimum 0.065" aluminum with integral (turned up) end dams and back dams. Minimum height of dams shall be 1".

- 03 Open vertical joint at end dam / back dam junction shall be welded continuous to form a seamless dam component directing any / all trapped water to outside of building. Provide thicker material than specified above if required to meet this requirement.
 - 04 Sub-sill flashing shall extend to the exterior building face / veneer and turn down 3/4".
 - 05 All exposed edges shall be ground to eliminate sharp edges and corners. Hemmed edges are acceptable.
 - 06 Finish of sub-sill flashing shall match frame finish.
- F. Miscellaneous Materials:
- 01 Provide material isolators at all dissimilar metals in contact with aluminum framing components.
 - 02 Where indicated on the Drawings provide minimum 0.080" aluminum extrusions or break metal between non-contiguous framing components (i.e. segmented radius walls, column wraps, etc.). Fabricate as required for concealed fastening.
- G. Glazing Materials at Aluminum Framing:
- 01 Glazing Gaskets: Extruded neoprene conforming to ASTM C502 (color "black"), sized to fit the frame.
 - 02 Sealant: Comply with Federal Spec. TT-S-00230.
- H. Glazing Materials at Hollow Metal Frames:
- 01 General: Use glazing compound and preformed glazing sealants approved for the application, except as otherwise specified, conforming to Glazing Materials portion of the FGMA Glazing Manual.
 - 02 Sealant:
 - a. One part acrylic polymer sealant conforming to Federal Spec. TT-S-00230 or silicone, Federal Spec. TT-S-0023-C. Use for glazing of all fixed glass. Include primer as recommended by manufacturer.
 - b. Color: Shall as selected by Architect from manufacturer's full range.
 - c. All sealants shall be compatible with adjacent material per manufacturer's recommendations and instructions.
 - 03 Setting Blocks: Hard rubber or clean grain softwood.
 - 04 Back-up Material: Foamed polyethylene or polystyrene rod stock; sizes as required by joint condition, and compatible with sealant.
 - 05 Glazing Tape: DAP #1202 or as approved.
 - 06 Glazing Gaskets: Extruded neoprene, free of porosity, surface defects, dimensional irregularities, and conforming to physical properties of ASTM C502.
 - 07 Use of metal sash putty will not be permitted, but compound conforming to Federal Spec. T-G-410 will be permitted. The use of non-skinning compounds, non-resilient type preformed sealers and preformed impregnated type gaskets will not be permitted.

2.4 GLASS MATERIALS

- A. Glass Type G-1: Insulated Fire Rated Glass:
- 01 Design is based on TPG FireLite IGU series.
 - 02 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.

- 03 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
- 04 Exterior / Outboard Lite shall be:
- a. Fully Tempered Tinted Glass.
 - b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall be XX
Note: can be any manufacturer's glass product.
- 05 Interior / Inboard Lite shall be:
- a. Clear FireLite Plus Glass with Premium surface finish.
 - b. Complying with Impact Safety Rating: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - c. Clear.
- B. Glass Type G-2: Fully Tempered Clear Glass:
- 01 1/4" thick.
- 02 Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
- 03 Clear.
- 04 Use at all non-fire-rated interior glazing unless indicated otherwise.
- C. Glass Type G-3: Fire-Rated Safety Wired Glass:
- 01 1/4" thick clear with fire-rated surface film.
- 02 Provide fire-rating of 20 minutes to 90 minutes for doors and 20 minute to 45 minute for other applications.
- 03 Complying with ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
- 04 Wire pattern shall be straight diamond mesh or square grid, as selected by Architect.
- D. Glass Type G-4: Insulated Glass:
- 01 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.
- 02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
- 03 Exterior / Outboard Lite shall be:
- a. Fully Tempered Tinted Glass.
 - b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall be XX.
- 04 Interior / Inboard Lite shall be:
- a. Fully tempered glass.
 - b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - c. Clear.
- E. Glass Type G-5: Insulated Spandrel Glass:
- 01 Overall thickness of 1" comprised of 2 lites of 1/4" glass separated by a 1/2" air space.
- 02 Air space to be dual sealed and meeting the certification requirements of the IGCC for a CBA rating.
- 03 Exterior / Outboard Lite shall be:
- a. Fully Tempered Tinted Glass.
 - b. Complying with ASTM C1048, Type I, Class 2 (tinted), Quality 3, Kind FT.
 - c. Tinting shall be XX.

- d. Ceramic Enamel Frit: color as selected by Architect from manufacturer's full range of available colors / finishes.
- 04 Interior / Inboard Lite shall be:
 - a. Fully tempered glass.
 - b. Complying with ASTM C1048, Type 1, Class 1 (clear), Quality 3, Kind FT.
 - c. Clear.
- F. Glass Type G-6: Acoustical Glass:
 - 01 Overall thickness of nominal 1" comprised of one lite of 1/4" clear laminated safety glass and one lite of 3/8" clear laminated safety glass separated by a nominal 3/8" air space.
 - 02 Laminating interlayer materials shall be Polyvinyl Butryal (PVB) sheet; .020" minimum.
 - 03 Dual sealed with a primary seal of polyisobutylene (PIB) and a secondary seal of silicone or organic sealant as recommended by the manufacturer for the specific application.
 - 04 Minimum STC Rating: 48
 - 05 Install in sound control door assemblies provided in Section 08 34 73 – Sound Control Door Assemblies; and window assemblies where indicated on the Drawings.

THE FOLLOWING ARE FOR HURRICANE / IMPACT RESISTANT GLAZING IF REQUIRED FOR TDI LARGE MISSILE IMPACT CERTIFICATION.

- G. Glass Type G-7: Hurricane Resistant Glass:
 - 01 Tinted, Insulated Laminated Glass (Hurricane Resistant).
 - 02 Thickness: 1".
 - 03 Exterior / Outboard Lite: Glass Type G-1 fully tempered, tinted glass.
 - 04 Interior / Inboard Lite: laminated glass comprised of 2 sheets of 1/4" thick, heat-strengthened glass, laminated with a .090" thick PVB interlayer.
 - 05 The laminated safety glass must have been tested and certified to meet the Texas Department of Insurance (TDI) Hurricane Resistance requirements indicated herein.
 - 06 Provide in "Solar Grey" "Solar Bronze" "XXXXXXX" tint.
- H. Glass Type G-8 - Hurricane Resistant Spandrel Glass:
 - 01 Monolithic Ceramic Enamel Frit Spandrel Laminated Glass.
 - 02 Overall Thickness: nominal 5/16" comprised of two sheets of 1/4" heat-strengthened glass, laminated with a .090" thick PVB interlayer.
 - 03 Ceramic Enamel Frit: color as selected by Architect from manufacturer's full range of available colors / finishes.
- I. Glass Type G-9: Spandrel Glass:
 - 01 Monolithic Ceramic Enamel Frit Spandrel Glass.
 - 02 1/4" fully tempered glass strengthened glass.
 - 03 Ceramic Enamel Frit: color as selected by Architect from manufacturer's full range of available colors / finishes.

2.5 EXTERIOR ALUMINUM STOREFRONT DOORS

- A. Exterior Aluminum Entrance Doors: design is based on Oldcastle "Rugged" WS Wide Stile door unit assembly.
 - 01 Nominal depth: 2", fabricated with 0.188" minimum thickness aluminum at all tubular sections.

- 02 Vertical Stiles: 5".
- 03 Top Rail: 5-3/4".
- 04 Bottom Rail: 10".
- 05 Standard Structural Shapes, Rolled or Extruded Aluminum: Alloy 6061-T6.
- 06 Connections: Provide bolted and welded connections, fit to a hairline joint.
- 07 Provide reinforcing at bolted attachments. Tapped aluminum is not permitted.
- 08 Provide concealed screws, nuts, bolts, and anchors, except hardware screws on hinge and closer-arm of door, of non-corrosive metal.
- 09 Finish: Clear anodized or medium bronze anodized aluminum.
- 10 Glass in Exterior Doors: Type G-2 G-4 G-7 at all exterior locations.
- 11 Use manufacturer's recommended gaskets for flush glazing (color "black").
- 12 Refer to Section 08 71 00 – Door Hardware for finish hardware requirements. Coordinate with other trades as required.

SPECIFIER: SELECT ONE OR MORE APPLICABLE SYSTEMS – OLDCASTLE ICR-225 OR RELIANCE WINDOW WALL SYSTEM FOR STANDARD NON-TDI APPLICATIONS.

2.6 EXTERIOR ALUMINUM FRAMING SYSTEMS

- A. Aluminum Storefront / Entrance Framing System: Basis of design is Oldcastle Series ICR-225.

- 01 Size: 2-1/4" x 6" mullion profile - front set, exterior loaded; available with butt glazed verticals; to accept 1/4", 1" glazing.
- 01 Pressure glazed, front set, exterior loaded; available with butt glazed verticals.
- 02 Provide sub-frames at door head / jambs on entrances as required to accept Rugged WS doors.
- 03 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet wind load criteria.
- 04 Intermediate horizontal mullions shall be undersized to 4-1/2" depth.
- 05 Finish: Clear anodized or medium bronze anodized aluminum.
- 06 Glass: Type G-1 or G-4 at all exterior locations. Provide glass Type G-5 where indicated.
- 07 Glass pockets shall be sized to accept glass specified.
- 08 Provide continuous, full depth sill flashing with end dams at all sill sections.

OR

- B. Aluminum Storefront / Entrance Framing System: Design is based on Oldcastle Reliance Curtain Wall series.

- 01 Size: 2-1/2" x 6", 7-1/4" 10-1/8" mullion profile; to accept 1" glazing.
- 02 Pressure glazed, front set, exterior loaded; available with butt glazed verticals.
- 03 Provide sub-frames at door jambs on entrances as required to accept Rugged WS doors.
- 04 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet wind load criteria.
- 05 Intermediate horizontal mullions shall be undersized a minimum of 1 inch less depth than perimeter / primary framing member size.
- 06 Finish: Clear anodized or medium bronze anodized aluminum.
- 07 Glass: Type G-1 or G-4 at all exterior locations. Provide glass Type G-5 where indicated.
- 08 Glass pockets shall be sized to accept glass specified.

- 09 Provide continuous, full depth sill flashing with end dams at all sill sections.

OR THE FOLLOWING OLDCASTLE HR-251 OR RELIANCE WINDOW WALL SYSTEM FOR TDI LARGE MISSILE IMPACT ZONE

- C. Design of Hurricane Resistant aluminum framing is based on Oldcastle series HR-251 Impact-Resistant System.
- 01 Size: 2½" x 6¾" mullion profiles; dry-glaze, fully gasketed to accept 1" insulated glass as specified and indicated.
 - 02 Pressure glazed, front set, interior loaded, stick wall system.
 - 03 Provide sub-frames at door head / jambs on entrances as required to accept Rugged WS doors.
 - 04 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet loading criteria.
 - 05 Intermediate horizontal mullions shall be undersized a minimum of 1 inch less depth than perimeter / primary framing member size.
 - 06 Finish: **Clear anodized or medium bronze** anodized aluminum.
 - 07 Glass: Type G-7 at all exterior locations. Provide glass Type G-8 where indicated.
 - 08 Provide continuous, full depth sill flashing with end dams at all sill sections.
- D. Design of Hurricane Resistant aluminum framing is based on Oldcastle series Reliance Window Wall System.
- 01 Size: 2-1/2" x 6", 7-1/4" 10-1/8" mullion profiles; dry-glaze, fully gasketed to accept 1" insulated glass as specified and indicated.
 - 02 Pressure glazed, front set, interior loaded, stick wall system.
 - 03 Provide sub-frames at door head / jambs on entrances as required to accept Rugged WS doors.
 - 04 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet loading criteria.
 - 05 Intermediate horizontal mullions shall be undersized a minimum of 1 inch less depth than perimeter / primary framing member size.
 - 06 Finish: **Clear anodized or medium bronze** anodized aluminum.
 - 07 Glass: Type G-7 at all exterior locations. Provide glass Type G-8 where indicated.
 - 08 Provide continuous, full depth sill flashing with end dams at all sill sections.

2.7 INTERIOR ALUMINUM FRAMING SYSTEMS

DELETE IF ALL INTERIOR FRAMING IS HOLLOW METAL

- A. Aluminum Framed Systems: design is based on Oldcastle FG-2000 Flush Glazed Storefront system:
- 01 Size: 1-3/4" x 4-1/2" mullion profile; center set, exterior loaded; to accept 1/4" glazing.
 - 02 Provide mullion reinforcement, if necessary, to achieve structural requirements to meet loading criteria.
 - 03 Finish: **Clear anodized or medium bronze** anodized aluminum.
 - 04 Glass: Type G-2.
 - 05 Glass pockets shall be sized to accept glass specified.
- B. Interior Aluminum Entrance Doors: design is based on Oldcastle Series 500 Wide Stile door unit assembly.

- 01 Nominal depth: 1-3/4", fabricated with 0.125" minimum thickness aluminum at all tubular sections.
- 02 Vertical Stiles: 5-1/2".
- 03 Top Rail: 4-1/2".
- 04 Bottom Rail: 8-1/2".
- 05 Standard Structural Shapes, Rolled or Extruded Aluminum: Alloy 6063-T5.
- 06 Provide concealed screws, nuts, bolts, and anchors, except hardware screws on hinge and closer-arm of door, of non-corrosive metal.
- 07 Finish: Clear anodized or medium bronze anodized aluminum.
- 08 Glass: Type G-2 at all interior locations.
- 09 Use manufacturer's recommended gaskets for flush glazing (color "black").
- 10 Refer to Section 08 71 00 – Door Hardware for finish hardware requirements. Coordinate with other trades as required.

2.8 SOLAR CONTROL DEVICES

- A. Design of solar control devices is based on Oldcastle Solar Eclipse sunshade; "Airfoil" (large) Series aluminum sunshade.
- B. Solar control devices shall be specifically engineered and fabricated for use specifically with the Oldcastle Reliance framing system.
 - 01 Projected depth: 36".
 - 02 Width: As required to fit parent window / opening frame.
 - 03 Design to meet all structural and required wind loads.
- C. Solar control devices shall be complete assemblies; comprised of brackets, anchors, outriggers, louvers and fascia that are anchored directly to the Aluminum framing vertical members.
- D. Finish: Clear anodized aluminum finish, all parts.

2.9 UNFRAMED MIRRORS

- A. Glass: Plate or float, 1/4 inch thick, Class 1, mirror glazing quality.
- B. Silvering: Electroplated copper backing with double paint protective coating.
- C. Guarantee: Five years against silver spoilage.
- D. Edges: Rounded off and polished.
- E. Mastic: Asphalt mirror setting cement approved by mirror manufacturer.
- F. Clamps: Knappe & Vogt No. 278 top, 3/8 inch. Provide 3/8 inch continuous aluminum J-shaped channel, as manufactured by J. G. Braun Co., for bottom support.

2.10 DISPLAY CASE GLASS DOORS and SHELVES

- A. Display Case Sliding Doors and, Hardware and Shelves:
 - 01 Glass: Type G6 – 1/4 inch, clear laminated safety glass.

02 Sliding Glass Door Frame: Based on The Engineered Products Co. (EPCO) Assembly No. 15, complete, for 1/4 inch glass by-passing doors.

a. Full side jambs.

b. Knob and Pulls.

03 Sliding Glass Door Lock: G05 lockset.

B. Shelves and Supports:

01 Shelf Supports: Knappe and Vogt model 80 series standard duty standard with series 180 shelf brackets.

02 Glass Shelves: 1/4" clear laminated safety glass, nominal 12" deep.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Thoroughly examine conditions at each and every location under which Work of this Section will be performed.

01 Verify that each rough opening is the correct size for the framing being installed. Maximum allowable joint at perimeter of framing shall be 5/8". Inform General Contractor of any non-conforming rough openings and do not proceed until unsatisfactory conditions are corrected.

02 Verify that the sub-sill substrate is continuous, solid, level and at the proper elevation for installation of sub-sill flashing. Sub-sill flashing must be set in a 100% bed of sealant without any voids. Do not proceed until unsatisfactory conditions are corrected.

B. Verify that wood blocking, thru-wall flashing, masonry and other adjacent work is installed as required for the proper installation of aluminum framing prior to proceeding. Inform General Contractor of any non-conforming work and do not proceed until unsatisfactory conditions are corrected.

C. Clean glazing channels, stops, and rabbets to receive the glazing materials, making free from obstructions and deleterious substances which might impair the work.

01 Remove protective coatings which fail in adhesion or interfere with bond of sealants.

02 Comply with manufacturer's instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes.

03 Prime surfaces to receive glazing compounds in accordance with manufacturer's recommendations.

3.2 INSTALLATION – ALUMINUM FRAMING

A. Install all aluminum framing in strict accordance with the manufacturer's installation standards and recommendations; firmly anchored for long life under hard use.

B. All exterior sill members shall be installed with continuous aluminum sub-sill flashing.

01 Set sub-sill flashing in 100% bed of sealant. Carefully clean off excess sealant after sub-sill flashing is set in place.

02 All fasteners used to anchor sub-sill flashing shall be completely bedded in sealant prior to installation of sill framing.

- 03 All fasteners securing sill framing which penetrates through sub-sill flashing shall be installed through a sealant bed as required to maintain the waterproof integrity of the sub-sill flashing / sill-framing assembly.
- 04 Coordinate with dampproofing sub-contractor to install additional thru-wall flashing at base of jambs to lap over / onto aluminum sub-sill flashing – prior to installation of aluminum framing member(s). Coordinate as required.
- C. Shim and center framing within rough opening. Maximum sealant joint at perimeter of framing shall be 5/8". Coordinate with other trades to correct rough opening where perimeter joint will exceed 5/8".
- D. Erection Tolerances:
 - 01 Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.
 - 02 Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.
 - 03 Maximum Deviation from True Alignment: 1/32 inch from any two abutting units; and horizontal components meeting at a vertical mullion. Allow no edge projections.
 - 04 Maximum Joint Cap: 1/32 inch.
 - 05 Maximum Openings Between Movable Glazing Stop and Adjacent Member: 1/32 inch.

3.3 INSTALLATION – GLASS

- A. Inspect each piece of glass immediately prior to start of installation.
 - 01 Do not install items which are improperly sized, have damaged edges, are scratched, abraded, or damaged in any other manner.
 - 02 Do not remove labels from glass until so directed by the Architect.
 - 03 Install glass so distortion waves, if present, run in a horizontal direction.
- B. Locate setting blocks at sills one quarter of the width of the glass in from each end of the glass, unless otherwise recommended by the glass manufacturer.
 - 01 Use blocks of proper size to support the glass in accordance with the manufacturer's recommendations.
 - 02 Provide spacers for all glass sizes larger than 50 united inches, to separate glass from stops, except where continuous glazing gaskets or felts are provided.
 - a. Locate spacers no more than 24 inches apart, and no closer than 12 inches to a corner.
 - b. Place spacers opposite one another.
 - c. Make bite of spacer on glass 1/4 inch or more.
- C. Set glass in a manner which produces the greatest possible degree of uniformity in appearance.
- D. Do not use two different glazing materials in the same joint system, unless the joint use is approved in advance by the Architect.
- E. Mask, or otherwise protect surfaces adjacent to installation or sealants.
- F. Install all glass, gasket and aluminum framing in strict accordance with manufacturer's printed instructions.

- G. Caulk joints continuous at exterior and interior faces of framing and elsewhere as indicated, as required to meet performance specifications using materials specified in Section 07 92 00 – Joint Sealants. Follow sealant manufacturer's printed instructions for the installation of his product.

3.4 FIELD TESTING

- A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
 - 01 Interior finishes at window recess (i.e. gypsum board, window sill) shall not be installed at window units to be tested.
 - 02 If interior finishes at window recess have been installed at windows to be tested, they shall be removed by Contractor prior to testing; and then reinstalled at no additional cost to the Owner.
- B. Manufacturer's representative shall be present to observe all field tests and retests.
- C. Testing:
 - 01 Testing shall be performed per AAMA 503 by a qualified independent testing agency.
 - 02 Air Infiltration Tests: Conduct tests in accordance with ASTM E 783.
 - a. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft², whichever is greater.
 - 03 Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105.
 - a. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 PSF.
- D. Failed Tests:
 - 01 Tests not meeting specified performance requirements and units having deficiencies shall be corrected by the Contractor and the failed window unit / area shall be retested.
 - 02 In addition to retesting the failed window unit / area, an additional two (2) similar window units / areas shall be tested.
 - 03 All retesting and testing caused by a failed test shall be at the expense of the Contractor.

3.5 PROTECTION

- A. Protect glass from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass.
 - 01 Do not apply warning markings, streamers, ribbons, or other items directly to the glass, except as specifically directed by the Architect.
- B. Protect all window framing during and after installation from marring, blemishes, scratches and damage due to incidental adjacent work.
 - 01 If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

END OF SECTION

SECTION 08 87 23

SAFETY AND SECURITY FILMS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Application of Safety and Security Film on interior glass surfaces as indicated or scheduled on the Drawings and as specified.
- C. Related Work:
 - 01 Section 08 11 13 – Hollow Metal Doors and Frames
 - 02 Section 08 11 16 - Aluminum Door and Glazing Frames
 - 03 Section 08 56 19 – Interior Transaction Windows
 - 04 Section 08 80 00 – Glazing

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements.
 - 05 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.

- 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
- 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 2" x 2" but must be large enough to convey attributes of the proposed product.
 - 04 Provide each type of finished brick to be provided in quantities sufficient to show range of color where applicable.
 - 05 Samples of brick ties proposed to be furnished.
 - 06 Samples of full range of actual mortar color selections. Paper or digital samples are not acceptable.
 - 07 Sample of mortar deflector proposed to be furnished.
- G. Sample / Mock-Up Panel: Coordinate with Glazing Contractor and other trades as required to install security film on the glazed frame and glass component on the mock-up panel.
- 01 Film shall be 8 mil.
 - 02 Include structural sealant joint at glass / frame intersection.
- H. Verification Sample: two samples of film on glass representing the actual product, color and pattern.

1.2 REFERENCES

- A. American National Standards Institute (ANSI):
- 01 ANSI Z97.1 - Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test.
- B. American Society for Testing Materials (ASTM):
- 01 ASTM C1499-09 - Monotonic Equibiaxial Flexural Strength of Glass (Double Ring Test).
 - 02 ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - 03 ASTM D1044 - Test Method for Resistance of Transparent Plastics to Surface Abrasion."
 - 04 ASTM D3330 - Standard Test Methods for Peel-Adhesion at 180 Degree Angle".
 - 05 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 06 ASTM E903 - Test Method for Solar Absorbance, Reflectance, and Transmittance of Materials Using Integrating Spheres"
- C. Consumer Product Safety Commission (CPSC):
- 01 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- D. National Institute of Justice:
- 01 Standard, NIJ-STD-0108.01.
- E. Code of Federal Regulations (CFR):
- 01 CFR Title 16 Part 1201 category I and II – Safety Standards for Architectural Glazing Materials

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All products provided under this Section shall be provided by a manufacturer with a minimum of five (5) years of experience.
 - 01 Engage a firm experienced in manufacturing systems similar to those indicated for this Project and meeting the standards of the International Standards Organization (ISO), ISO 9001 Quality Assurance in Production and Installation.
- B. Installer Qualifications:
 - 01 Engage an experienced installer certified, licensed, or otherwise qualified by film manufacturer as having the necessary experience, staff, and training to install manufacturer's products according to specified requirements.
 - 02 Manufacturer's installer shall have a minimum of five (5) years of experience in installing safety and security films.
- C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 WARRANTY

- A. Submit a written warranty, executed by the film manufacturer, agreeing to repair or replace defective safety and security film for a warranty period of minimum ten (10) years.
- B. Failures include, but are not limited to:
 - 01 Delamination, peeling, cracking, crazing.
 - 02 Failure of the structural sealant.
 - 03 Objectionable appearance / discoloration

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of Safety and Security Films is based on products / systems provided by C-Bond Systems.
- B. Acceptable Manufacturers: the following manufacturers are acceptable to provide safety and security films provided proposed products meet or exceed all specified requirements, and characteristics / attributes of the basis of design product(s).
 - 01 3M
 - 02 Armor Glass International
 - 03 Llummar
 - 04 Madico
- C. Design of structural sealant is based on products manufactured by Dow Corning 995 Silicone Structural Sealant.
- D. Acceptable Manufacturers: the following manufacturers are acceptable to provide structural sealants provided proposed products meet or exceed all

specified requirements, and characteristics / attributes of the basis of design product(s).

- 01 GE
- 02 Tremco

2.2 FILM MATERIALS

- A. Design of Safety and Security Films is based on C-Bond Systems Security Films.
 - 01 The security film shall be a complete system, including film and continuous structural sealant at perimeter of glazing panel.
 - 02 Safety Glazing – in accordance with the CPSC 1201 and the ANSI Z97.1 standards.
 - 03 Minimum thickness of glass to be 1/4" inch (6 mm) annealed (non-tempered) monolithic or insulated units, utilizing the C-Bond technology, a patented, non-toxic, water-based, nano-technology.
 - 04 Color: Clear
- B. Performance Properties:
 - 01 Thermal and Optical Performance Properties: Provide glazing films that will not affect the thermal and optical performance characteristics as established by the glass components scheduled for curtain wall, storefront and entrance glazing.
 - 02 Flexural Glass Strength: When tested in accordance with ASTM C1499-09, Monotonic Equibiaxial Flexural Strength of Glass (Double Ring Test), the application of the mounting fluid/alone shall strengthen the glass to percentages up to and over 250 percent, and improve the flexure properties of the glass to percentages up to and over 130 percent.
- C. Glazing Film Accessories
 - 01 General: Provide products complying with requirements of glazing film manufacturer for application indicated and with a proven record of compatibility with surfaces contacted in installation.
 - 02 Adhesive: Types recommended by glazing film manufacturer and nano-technology fluid manufacturer.
 - 03 Cleaners, Primers, and Sealers: Types recommended by glazing film manufacturer.
- D. Film material shall be 8.0 mil at specified locations specifically designed for glazing security applications.
 - 01 Security film shall be installed full width at both doors and windows at the specified locations on the interior surface of the glass.
 - 02 At each required location, film shall be installed from the nearest horizontal mullion at or above 8'-0" above finish floor to the bottom of the glazed panel
 - 03 Film for exterior and interior glazing shall be clear.
- E. Locations to receive 8 mil security film:
 - 01 Interior entry vestibule wall (between the front entry and the interior of the school) door glass panels, sidelights and adjacent glazing.
 - 02 Interior glazing at Reception counter.
 - 03 Interior operable windows at Reception counter.
 - 04 As indicated on the drawings

2.3 STRUCTURAL SEALANT MATERIALS

- A. Design of Structural Sealant is based on Dow Corning 995 Silicone Structural Sealant.
 - 01 Dow Corning® 995 Silicone Structural Glazing Sealant is a one-component neutral-curing silicone sealant designed specifically for structural bonding applications of glass and metal in factory or field situations.
- B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use NT; ASTM C1184; SWRI validation.
 - 01 Hardness, ASTM D2240: 35 - 45 durometer Shore A, minimum.
 - 02 Volatile Organic Compound (VOC) Content: 34 g/L maximum.
 - 03 Ultimate Tensile, ASTM D412: 300 psi (2.2 MPa), at 21 day cure (Dumbbell)
 - 04 Ultimate Tensile, ASTM C1135: 160 psi (1.1 MPa), at 21 day cure (TA Joint)
 - 05 Color: As selected by Architect from manufacturer's full line of not less than 3 colors.
- C. Compatibility: Provide joint sealants and accessory materials that are compatible with one another, with joint substrates, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer by testing and related experience.
- D. Structural Glazing Sealants: Comply with ASTM C1184 and other specified requirements for each liquid-applied structural glazing sealant where indicated.
- E. A minimum bead of 1/2" (.50") overlapping the exposed edge of the security film, and 1/2" (.50") overlapping the window frame/glazing system shall be used on all installations.
- F. Structural adhesive to be color matched whenever possible, as allowed by availability from structural sealant manufacturer. Color matched is described as matching the color of the existing glazing bead/gasket.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Do not begin until glazing work is complete.
- B. Examine glazing work to determine suitability for safety and security film installation to commence. Notify Contractor of any discrepancies; and do not proceed until resolved.

3.2 PREPARATION

- A. Verify all conditions at glazing framing material and follow sealant manufacturer's specific instructions for preparation of frame material(s).
- B. Comply with manufacturer's written instructions for surface preparation.

- C. Prepare surfaces using methods and materials recommended by the manufacturer for the specific installation.
- D. Protect window frames and adjacent work from damage during installation.

3.3 FILM INSTALLATION

- A. Install all safety and security film in strict accordance with the manufacturer's installation instructions, standards and recommendations.
- B. Rough-cut film to size slightly larger than glass panel it is to be applied to.
- C. Remove protective backer from adhesive side of film.
- D. Spray both the glass and adhesive side of film with the slip solution, comprised of baby shampoo or dishwashing liquid and water, to facilitate proper positioning of film on glass.
- E. Apply film to glass and lightly spray film with slip solution.
- F. Scribe film to glass / frame juncture and cut film to fully fit the glass pane; taking care to keep film flat on glass while cutting.
- G. Squeegee from top to bottom of film and side-to-side removing slip solution between film and glass. Apply another spray coat of slip solution and squeegee a second time.
- H. Allow film installation to dry thoroughly; and to allow film to dry flat.
- I. After installation, view film from a distance of 10 feet against a bright uniform sky or background. Film shall appear uniform in appearance with no visible streaks, banding, thin spots or pinholes. If installed film does not meet this criteria, remove and replace with new film.

3.4 SEALANT INSTALLATION

- A. Clean excess slip solution resulting from squeegee operation from glass and frame surfaces to receive structural sealant.
- B. Apply continuous, removable paint tape to frame and glass surface at head, jambs and sill. Tape should be located 1/2" to 3/4" from the glass / frame juncture.
- C. Apply structural sealant continuously at head, jambs, sill, stop or similar element terminating the glass.
- D. Shape to an even beveled / fillet shape.
- E. Remove paint tape to result in clean, continuous structural sealant bead bonding film to frame.
- F. Allow structural sealant to cure a minimum of ten (10) days. Protect from damage as required.

3.5 CLEANING

- A. Remove excess mounting fluid at finished seams, perimeter edges, and adjacent surfaces.

- B. Use cleaning methods recommended by glazing film manufacturer.
- C. Replace films that cannot be cleaned.
- D. Clean installed film with approved cleaners only. Contact nano-technology manufacturer for approved cleaning fluids.

3.6 PROTECTION

- A. Protect glass film from damage by promptly installing streamers or ribbons, suitably attached to the framing and held free from glass.
- B. Protect all glass film during and after installation from marring, blemishes, scratches and damage due to incidental adjacent work.
- C. If damaged, make all necessary repairs or replacements in accordance with the manufacturer's recommendations and as directed by the Architect.

END OF SECTION

SECTION 08 90 00

LOUVERS AND VENTS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide louvers and vents in exterior walls as indicated on the Drawings.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 07 65 26 – Self-Adhering Sheet Flashing
 - 03 Section 09 21 16 – Gypsum Board Assemblies

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.2 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA):
 - 01 AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.
- B. Air Movement and Control Association (AMCA):
 - 01 AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
 - 02 AMCA 511 - Certified Ratings Program for Air Control Devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of louvers and vents is based on products Ruskin.
- B. Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this Section provided proposed products meet or exceed all specified requirements:
 - 01 Airstream Products
 - 02 All-Lite
 - 03 Construction Specialties, Inc.

2.2 MATERIALS

- A. Design of louvers is based on Ruskin Model ELF375DX fixed blade louver.
- B. Louver Materials and Fabrication:
 - 01 Performance Ratings: AMCA licensed.
 - 02 Size(s): As indicated on the Drawings.
 - 03 Frame:
 - a. Material: Extruded aluminum, Alloy 6063-T5.
 - b. Wall Thickness: 0.081 inch (2.1 mm), nominal.
 - c. Depth: 4 inches (102 mm).
 - d. Downspouts and caulking surfaces.
 - 04 Blades:
 - a. Style: Drainable.
 - b. Material: Extruded aluminum, Alloy 6063-T5.
 - c. Wall Thickness: 0.081 inch (2.1 mm), nominal.
 - d. Angle: 37.5 degrees.
 - e. Centers: 5-3/32 inches (129 mm), nominal.
 - 05 Bird Screen:
 - a. Material: Aluminum 1/2 inch mesh x 0.063 inch intercrimp.
 - b. Frame: Removable, rewireable.
 - c. Gutters: Drain gutter in head frame and each blade.
 - d. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
 - e. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches (3,048 mm).
 - f. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
 - g. Assembly: Factory assemble louver components. All welded construction.

- C. Performance Data:
 - 01 Based on testing 48-inch x 48-inch size unit in accordance with AMCA 500.
 - 02 Free Area: 54 percent, nominal.
 - 03 Free Area Size: 8.58 square feet.
 - 04 Maximum Recommended Air Flow Thru Free Area: 873 feet per minute.
 - 05 Air Flow: 7,490 cubic feet per minute.
 - 06 Maximum Pressure Drop: 0.15 inches W.G.
 - 07 Water Penetration: Maximum of 0.01 ounces per square foot (3.1 g/m²) of free area at an air flow of 873 feet per minute (266 m/min) free area velocity when tested for 15 minutes.
- D. Design Load: Incorporate structural supports required to withstand wind load of 30 PSF.
- E. Sub-Sill Flashing:
 - 01 All louvers shall be furnished with continuous sub-sill flashing, spanning the full width of the rough opening.
 - 02 Sub-sill flashing shall be minimum 0.065" aluminum with integral (turned up) end dams and back dams. Minimum height of dams shall be 1".
 - 03 Open vertical joint at end dam / back dam junction shall be TIG welded continuous to form a seamless dam component directing any / all trapped water to outside of building.
 - 04 Finish of sub-sill flashing shall match louver finish.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate with Contractor and other trades as required for rough opening and blocking requirements for proper installation of louver and vent assemblies.
- B. Confirm rough opening size and preparation are correct prior to start of installation.

3.2 INSTALLATION

- A. Install work of this Section in strict accordance with manufacturer's printed instructions and final accepted submittals.
- B. Louver sub-sill flashing shall be set in a full bed of sealant.
- C. Coordinate to have all sides of louver and vents sealed continuous to adjacent materials.
- D. For operable louvers and vents, completely test all functions to confirm all mechanical elements of the assembly are functioning correctly.
- E. Provide continuous sealant at perimeter of frame after installation.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #955-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Interior metal framing – studs and joists.
 - 02 Interior gypsum board at walls, including trim, taping and floating.
 - 03 Interior gypsum board at ceilings, including trim, taping and floating.
 - 04 Interior glass-mat backer board at ceramic tile and masonry wall finishes.
 - 05 Exterior sheathing.
- C. Related Work:
 - 01 Section 05 41 00 – Structural Metal Stud Framing
 - 02 Section 05 50 00 – Metal Fabrications
 - 03 Section 06 10 00 – Rough Carpentry
 - 04 Section 07 21 00 – Thermal Insulation
 - 05 Section 07 21 19 – Foamed-in-Place Insulation
 - 06 Section 07 25 00 – Weather Barrier
 - 07 Section 07 84 13 – Penetration Firestopping
 - 08 Section 09 51 13 – Acoustical Tile Ceilings
 - 09 Section 09 91 00 – Painting and Re-Painting

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Where proposed framing solutions exceed specified maximum allowable unbraced heights, submit engineered calculations for each specific condition; sealed and signed by a Texas licensed structural engineer.

- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
- 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM):
- 01 ASTM C473 – Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - 02 ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 03 ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by Hot-Dip Process.
 - 04 ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board.
 - 05 ASTM C954-10 – Standard Specifications for Steel Drill Screws for the Application of Gypsum Panel Products to Steel Studs.
 - 06 ASTM C1002 – 07 – Standard Specifications for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products to Steel Studs.
 - 07 ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
 - 08 ASTM C1178 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - 09 ASTM C1280 – Standard Specification for Application of Gypsum Sheathing.
 - 10 ASTM C1396 – Standard Specification for Gypsum Board.
 - 11 D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 12 ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
- B. Gypsum Association:
- 01 GA-214 – Recommended Levels of Gypsum Board Finish.
 - 02 GA-216 – Application and Finishing of Gypsum Panel Products.
 - 03 GA-253 – Application of Gypsum Sheathing.
 - 04 GA-290 – Area Separation Walls.
 - 05 GA-600 – Fire Resistance Design Manual.
- C. National Fire Protection Association:
- 01 NFPA 285 – Standard Fire Test Methods for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Materials.

1.4 DESIGN REQUIREMENTS

- A. Non-Load-Bearing Metal Framing Deflection:
- 01 L/360 at 5 PSF for veneer plaster and direct-applied finish materials that use grout or mortar.
 - 02 L/240 at 5 PSF for typical gypsum board walls.

- B. Fire-Resistive Rating: Where indicated on Drawings, provide materials and construction that are identical to those assemblies whose fire resistance rating has been determined per ASTM E119 by a testing and inspecting organization acceptable to authorities having jurisdiction.
- C. Meet or exceed fire resistance requirements outlined under provisions of the GA-600 Fire Resistance Design Manual for wall and ceiling assemblies.
- D. Meet or exceed Class A flame/fuel/smoke requirements of ASTM E84 surface burning characteristics for finish materials.
- E. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.
- F. Impact-Resistant Characteristics: No structural failure at 400 foot pounds per ASTM E195.
- G. Mold-Resistant Characteristics: Rating of 10 according to ASTM D3273 mold testing.
- H. Recycled Content Certification: Provide gypsum board of at least 95 percent recycled content.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or damage metal corner beads and trim.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The design of metal stud drywall framing and similar components is based on products manufactured by ClarkDietrich.
- B. The following additional metal stud framing manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 Cemco
 - 02 Marino/Ware
 - 03 Mill Steel
 - 04 The Steel Network
 - 05 Telling Industries
- C. Gypsum Wall Board: Provide domestically-manufactured gypsum wall board.
 - 01 American Gypsum
 - 02 Georgia Pacific

- 03 James Hardie Industries
 - 04 National Gypsum Company
 - 05 Temple–Inland Forest Products Corp.
 - 06 U. S. Gypsum Co.
- D. Exterior Sheathing:
- 01 Georgia Pacific, “Dens Glass Gold” – basis of design.
 - 02 National Gypsum, Gold Bond “eXP” Extended Exposure Sheathing
 - 03 Temple-Inland Forest Products Corp. “Green Glass”
 - 04 U.S. Gypsum “Securock”
- E. Glass-Mat Backer Board:
- 01 USG Durock – basis of design.
 - 02 Certaineed
 - 03 James Hardie Industries
- F. Substitutions of above must be approved by the Architect ten (10) days prior to Proposal / Bid Date.

2.2 STUD FRAMING MATERIALS

- A. The Drawings indicate locations of partitions / stud framing and the size of the stud to be used. The Contractor is responsible for providing the appropriate stud mil thickness relative to the height and configuration of the assembly.
- 01 The minimum thickness for all interior framing materials shall be 33 mils.
 - 02 Physical features of materials proposed to be furnished shall meet or exceed all requirements outlined below.
- B. All metal framing members shall be channel type, screw type studs and runners, punched cee studs.
- 01 33 mil and 43 mil material fabricated from steel with minimum 33 KSI yield strength.
 - 02 54 mil and heavier materials fabricated from steel with minimum 50 KSI yield strength.
 - 03 Conforming to ASTM C645 Standard Specification for Non-Structural Steel Framing Members.
 - 04 Minimum G-40 galvanized steel – ASTM A653. Galvannealed material is not acceptable. Coating equivalents are not acceptable.
 - 05 Provide in sizes as indicated on the Drawings and required for the actual installation assembly.
- C. Interior partition and similar metal framing is based on three (3) primary stud thicknesses. The following is the minimum Mil thicknesses for studs:
- 01 33 Mils minimum stud thickness to be provided at any location; unless indicated otherwise on the Drawings or required to be heavier by Specification or unbraced assembly height as determined by the installer.
 - 02 43 Mils (18 Gauge).
 - 03 54 Mils (16 Gauge).
 - 04 68 Mils (14 Gauge).
- D. Mil thicknesses of studs shall be based on 16” O.C. framing with the maximum, laterally unbraced height at each condition in accordance with the following schedule based on gypsum board applications:
- 01 5 PSF at L/240 conditions; standard gyp board drywall partitions to receive a painted or vinyl wall covering finish.

	<u>Stud Size</u>	<u>Height 33 Mils</u>	<u>Height 43 Mils</u>	<u>Height 54 Mils</u>	<u>Height 68 Mils</u>
	2-1/2"	13'-10"	N/A	N/A	N/A
	3-5/8"	16'-9"	18'-3"	19'-6"	20'-10"
	6"	24'-9"	27'-2"	29'-2"	31'-3"
02	5 PSF at L/360 conditions; gyp board drywall partitions to receive a finish material utilizing grout, mortar or plaster.				
	<u>Stud Size</u>	<u>Height 33 Mils</u>	<u>Height 43 Mils</u>	<u>Height 54 Mils</u>	<u>Height 68 Mils</u>
	2-1/2"	11'-8"	N/A	N/A	N/A
	3-5/8"	14'-8"	15'-11"	17'-1"	18'-3"
	6"	21'-8"	23'-9"	25'-6"	27'-3"
03	Where heights exceed limits stated above, framing at less than 16" O.C. or use of heavier mil thicknesses shall be allowed, conditional on submittal of engineered calculations for each specific condition; sealed and signed by a Texas Licensed Structural Engineer.				

- E. The gross Section Modulus (Sx) value for interior metal framing members shall be minimum:

<u>Member Size</u>	<u>33 Mil Sx</u>	<u>43 Mil Sx</u>	<u>54 Mil Sx</u>	<u>68 Mil Sx</u>
2-1/2"	0.180	0.238	0.288	0.355
3-5/8"	0.258	0.334	0.410	0.503
6"	0.520	0.675	0.832	1.026

- F. All above material mil thicknesses, performance criteria and related values are minimum requirements.

- 01 Under NO circumstances shall any stud product less than 33 mils be acceptable.
- 02 Gauge equivalent / dimpled and similar products whose base materials do not meet the above criteria, performance and properties shall not be accepted under any circumstances.
- 03 The "ProSTUD 33" series as manufactured by ClarkDietrich meets all criteria and is acceptable. Track sections from the ProSTUD 33 system are acceptable.
- 04 The "ViperStud 20 STR 33 mil" series as manufactured by Marino Ware meets all criteria and is acceptable. Track sections from the ViperStud 20 STR 33 mil system are acceptable.

- G. Stud tracks shall be provided in the same mil thickness or heavier than the studs they are associated with.

- 01 Stud sill / floor track leg height shall be minimum 1-1/4".
- 02 Head tracks which anchor to structural steel or floor / roof deck shall have a minimum 2" leg height (deep track) and be fabricated and installed to allow movement and flexibility of studs nested within the track.

- H. Studs at all framed door and window openings shall be installed with full-height (floor to top of wall), double studs at jambs.

- 01 Double studs at opening shall be clipped / fastened together to result in a single composite assembly.
- 02 Coordinate with other trades where additional miscellaneous steel bracing is required.
- 03 Framed openings for mechanical ductwork and similar work shall be framed as required for the assembly.
- 04 Fastening studs directly to ductwork is not permitted. Coordinate with other trades as required. Adhere to U.L. requirements at fire rated partitions.

- I. Metal framed partitions scheduled to receive tile finish or other applied finishes containing mortar or grout shall be increased to the next higher mil thickness for the height designated above.
 - 01 Examples: 33 mil increased to 54 mil; 54 mil increased to 68 mil.
 - 02 No increase is required for 68 mil framing.
 - 03 Contractor's option: stud framing size / mils based on height limitations per above may be installed at 8" O.C. in lieu of the stated increase in mil thickness.
- J. Structural metal stud bracing is required at each door opening 48" or wider.
 - 01 Provide two (2) 54 mil studs at each jamb of frame.
 - 02 Studs shall be fastened together to form a single composite unit.
 - 03 Studs shall extend and be secured to steel structure above.
 - 04 Field verify conditions and requirements.
- K. Horizontal Bracing: shall be minimum 54 Mil cold rolled channels with 1/2" legs. Provide in sizes in accordance with punched openings in studs.
 - 01 Horizontal bracing shall be either welded in place to each stud; or fastened with a clip specifically designed for the purpose.
 - 02 Provide one row of horizontal bracing at mid-span of partitions up to 12'-0" high; and at 5'-0" O.C. for partitions higher than 12'-0".
- L. Provide all accessories including, but not limited to, tracks, clips, web stiffeners, spacers, anchors, fastening devices, resilient clips, and other accessories required for a complete and proper installation, and as recommended by the manufacturer for the steel member and assembly being used.
- M. Ceiling Framing:
 - 01 U-Channel Framing: Minimum 1-1/2" x 54 mil cold rolled steel channels with hot dip galvanized finish. Use for primary framing at suspended ceilings and elsewhere as indicated.
 - 02 Furring Channels: Standard 2-3/4" wide, 7/8" deep x 30 mil minimum galvanized sheet metal furring channels.
 - 03 Ceiling Hanger and Tie Wire: 9 gauge galvanized hanger wire and 16 gauge tie wire.
 - 04 Fixture Reinforcement: 6 inch, 14 gauge / 68 mil cold rolled steel galvanized channels.
- N. Wall Furring:
 - 01 Furring Channels: standard 1-1/2" and / or 7/8" deep x 30 mil minimum galvanized sheet metal 'hat section' furring channels.
 - 02 Refer to Drawings for size at each application.
- O. Metal to Metal Connections:
 - 01 Framing fasteners shall be self-drilling / self-tapping screws.
 - 02 Framing screws shall be #10-16x5/8" hex washer head screw.
 - 03 Welded connections shall be fillet or flare welds as recommended by the manufacturer for the specific connection conditions.

2.3 WALL AND CEILING BOARD MATERIALS

- A. General Design Basis: All gypsum wallboard shall be USG 5/8 inch thick, Type X, tapered-edged. Sizes shall be 4'-0" wide by longest practical length to minimize joints.
 - 01 Suitable for use in fire rated assemblies.

- B. Humidity Resistant Gypsum Wallboard shall be USG 5/8", Type X, Sheetrock "Mold Tough" gypsum panels.
- 01 Panels shall comply with ASTM D3273.
 - 02 Use at all walls and ceilings in high humidity rooms (locker rooms, shower rooms / stalls, food service areas / rooms, restrooms, non-air-conditioned interior spaces / rooms) that do not receive a tile or masonry finish.
 - 03 Also provide within 24" of all sinks and lavatories.
- C. Tile or Masonry Finish Substrate: A cement-based backer board manufactured specifically for tile substrate and use in wet locations. Use as wall board substrate at all tile or masonry finished surfaces.
- 01 Minimum 5/8 inch thick.
 - 02 Provide / install in greatest size sheets possible (48" x 96" or larger) to minimize joints.
 - 03 Use joint reinforcement and fasteners in accordance with manufacturer's printed instructions.
- D. Acceptable manufacturers / products include:
- 01 USG "Durock" (basis of design).
 - 02 James Hardie Industries "HardieBacker".
 - 03 National Gypsum "Permabase".
- E. Gypsum Board Moisture Guard:
- 01 Design of gypsum board moisture guard is based on products manufactured by WaterGuard; or equal approved by the Architect.
 - 02 Continuous extruded PVC specifically designed to fasten to bottom of gypsum board sheet to maintain consistent elevation above floor slabs.
 - 03 Standard size at non-fire-rated partitions: 1-3/4".
 - 04 Standard size at fire-rated partitions: 1/2".
- F. Corner Beads: Design is based on USG Dur-A-Bead Corner Bead
- 01 Complies with ASTM C1047
 - 02 1-1/4" legs.
 - 03 Material Thickness: 0.012" minimum
 - 04 Use at all exterior corners.
- G. Joint Compound (Taping): Standard types manufactured by gypsum wallboard manufacturer for intended use. Fire rated type must be used on fireproof systems.
- H. Laminating Adhesives: Standard type manufactured or recommended by manufacturer of product to be laminated.
- I. Gypsum board reveals shall be 1/2" wide by 5/8" deep drywall reveals; extruded aluminum, painted finish.
- 01 Provide where indicated on the Drawings.
 - 02 Acceptable manufacturers / products include:
 - a. Gordon 'Final Forms I' Series 500 (basis of design).
 - b. Fry Reglet - "DRM" Series.
 - c. Pittcon - "SWR" Series.
- J. Control Joints: Metal type with 1/4 inch open joint, perforated flanges for floating in place.
- 01 Niles Building Products model 093 Zinc Control Joint; or equal.
 - 02 Control joints at walls shall be located vertically.

- a. A maximum of 30'-0" O.C. floor to above ceiling.
 - b. Each side of door frames from top of jamb to above ceiling.
 - c. Above ceiling, cut / separate gyp board full height to top of gyp board.
 - 03 Control joints at gypsum board ceilings shall be located:
 - a. As indicated on the Drawings
 - b. Where not indicated, at a maximum of 30'-0" O.C. Coordinate with Architect for exact locations.
 - 04 Control joints at furdawns shall be located on all sides of the furdawn at a maximum of 30'-0" O.C. to above ceiling.
 - 05 At building expansion joints, provide control joint full height of gyp board unless detailed or specified otherwise.
- K. Exterior Sheathing:
- 01 Mold-resistant, fire-rated glass-mat gypsum sheathing board.
 - 02 Thickness: 5/8 inch (16 mm).
 - 03 Properties: Enhanced mold resistance per ASTM D3273. Glass facers on both sides.
 - 04 Water absorption less than 6 percent per ASTM C473.
 - 05 Configuration: Forty-eight inches (1219 mm) wide by length required with square edges for horizontal application.
- L. Fasteners (screws) shall be U.S.G. type "S" drywall screws, minimum 1-1/4" length, or longer as required to penetrate metal framing components a minimum of 1/2".

2.4 GLASS-MAT BACKER BOARD

- A. Design of glass-matt backer board is based on USG Durock Tile Backerboard.
- B. Treated water-resistant gypsum core that is covered with a coated fiberglass mat-facer and cementitious surface, specifically designed for use as a substrate for direct applied tile of masonry.
- C. Properties:
 - 01 Thickness: 5/8".
 - 02 Size: 48" x 96".
 - 03 Mold Resistance: 10 maximum per ASTM D3273.
- D. Fasteners: Design is based on USG Durock Tile Backer Screws.
 - 01 Length: 1-5/8".
 - 02 Corrosion resistant screws complying with ASTM B117.
 - 03 Specifically designed for attachment of glass-mat backer board.

PART 3 - EXECUTION

3.1 METAL FRAMING INSTALLATION

- A. Floor Track: Attach to floor at 24 inch maximum centers with shoot-in pins or concrete nails.
- B. All metal framing shall extend to floor or roof structure / deck above, unless shown otherwise on the Drawings.
 - 01 Fasten tracks at 24" intervals and more often where necessary.

- 02 Where framing is perpendicular to joists, provide additional bracing as required.
 - 03 At fire rated partitions, framing shall extend full height to floor or roof deck above to allow a full, tight fit and seal of gyp board to be applied.
 - 04 Where studs are indicated to extend only above ceiling, brace to structure or other suitable framing at intervals not to exceed 32" O.C. each side and staggered. Framing used for bracing shall be minimum 33 Mil members.
- C. Studs:
- 01 Single lengths positioned vertically in the runners, spaced 16 inches O.C. maximum unless otherwise shown.
 - 02 Install double studs at framed opening jambs. Install stud bracing on each side of opening at frame head height between jamb studs and adjacent studs.
 - 03 Secure studs to stud track on both sides at bottom track prior to installation of gyp board.
 - 04 Where framing extends to structure or floor / roof deck, secure studs to both sides at bottom track prior to installation of gyp board. Temporarily fasten top track to stud as required to hold plumb in place. Secure / fasten gyp board to studs +/- 1" below bottom of track leg. Do not permanently fasten gyp board or stud directly to top track. Remove temporary track fastener to provide vertical movement of studs within the top track.
 - 05 Where studs are indicated to extend only above ceiling, secure studs to both sides at top and bottom track prior to installation of gyp board. Brace to structure or other suitable framing at intervals not to exceed 32" O.C. one side only. Coordinate with other trades as required to avoid conflict.
- D. Wall Reinforcement:
- 01 Provide horizontal bridging in all stud walls in accordance with the manufacturer's standards and recommendations.
 - 02 Provide solid, 2x (2x4 min.) treated wood blocking, spanning between wall studs, at all wall mounted fixtures, finish hardware, toilet partitions, wall cabinets, toilet accessories, specialties, built-in work and similar locations as required to provide a suitable substrate for firm attachment of other work.
- E. Chase-Wall Bracing:
- 01 Install cross-bracing for chase wall construction; Mil thickness of bracing to equal stud Mil thickness.
 - 02 Space braces a maximum of 36 inches vertically on every pair of studs.

3.2 WALLBOARD INSTALLATION

- A. Select the maximum practical length to minimize end joints. All end joints shall be neatly fitted and staggered. Joints on opposite sides of partition shall be so arranged as to occur on different studs.
- B. Install metal corner bead at external corners. Where length of the corner does not exceed standard stock lengths, use a single length.
- C. Install gypsum board moisture guard on the bottom of all gypsum board sheets set at / on finish floor slabs.

- D. Install metal trim where indicated and all wall board not terminating under frames or behind bases shall be trimmed with galvanized "J" mold.
- E. Apply at least three coats of joint compound over beads, screw heads and trim, and each coat shall be feathered out onto panel faces. Refer to Paragraph 3.8 Workmanship Tolerances for level of finish required.
- F. Float out and sand joints to make joints invisible when painted with non-texture paint. Refer to Paragraph 3.8 Workmanship Tolerances for level of finish required.
- G. Caulk around pipes, ducts, structure or similar items which penetrate drywall systems.
- H. Fasten wallboard at 12 inches O.C., except at the edges/joints which shall be at 8 inches O.C.
- I. Edge-Grip Clips: Position clips on the back of the panels and drive prongs into panel edges. Space clips 16 inches O.C. Screw-attach clip to framing, furring or wall surface.
- J. At all wrap-around hollow metal frames, gyp board shall extend ½" minimum into frame throat.
- K. At all exterior metal framed walls extend gypsum wall board from floor to deck unless noted otherwise.

3.3 SHEATHING INSTALLATION

- A. Install sheathing in accordance with manufacturer's instructions and applicable instructions in Gypsum Association -253 and ASTM 1280.
- B. Install using maximum lengths possible to minimize the number of joints.
- C. Secure sheathing to metal framing with hot dip galvanized screws spaced 8 inches O.C. at perimeter of board and 12" O.C. in field of board. Do not countersink fasteners; drive them to bear flush with surface of sheathing. Locate fasteners at least 3/8" from edges.
- D. Provide sheathing at all exterior metal framed walls unless noted otherwise. Install with all joints tight.
- E. Accurately cut and scribe at interfacing / penetrating work.
- F. Coordinate with the installation of dampproofing above grade. Refer to Section 07 11 13 – Bituminous Dampproofing.

3.4 GLASS-MATT BACKER BOARD

- A. Install glass-mat backer board at all interior wall surfaces to receive direct applied ceramic or similar tile, plaster and thin-set masonry.
- B. Install in full size sheets as much as possible to minimize joints.
 - 01 Install backer board with ends and edges closely abutted but not forced together.
 - 02 Stagger end joints in successive courses.

- C. Fastening:
- 01 For wall application, fasten glass-mat backer board to framing with specified fasteners.
 - 02 Drive fasteners into field of panels first, working toward ends and edges.
 - 03 Hold panels in firm contact with framing while driving fasteners.
 - 04 Space fasteners maximum 8" O.C. with perimeter fasteners at least 3/8" and less than 5/8" from ends and edges.
 - 05 Drive screws so bottoms of heads are flush with panel surface.
 - 06 Do not overdrive fasteners.

3.5 CEILING FRAMING INSTALLATION

- A. Main Runners: Hanger wires (9 gauge) shall be spaced not over 4'-0" in the direction of 1-1/2 inch main runner channels, not over 4'-0" in the direction of right angles to the main runners, and within 6 inches of the ends of main runners and of boundary walls, girders or similar interruptions of ceiling continuity.
- 01 Do not place over 4'-0" O.C., properly positioned and leveled.
 - 02 Suspension of ceiling framing from joist bridging is not permitted.
- B. Furring Channels: Space 16 inches O.C., and saddle-tie with two strands of 16 gauge tie wire to main runners or main support members.
- 01 Do not let into or come in contact with abutting masonry walls.
 - 02 End splices shall be provided by nesting channels or studs no less than 8 inches and securely wire-tie.

3.6 CEILING BOARD INSTALLATION

- A. Apply gypsum board of maximum practical length with the long dimension at right angles to the furring channel and fastened with 1 inch drywall screws spaced 12 inches O.C. in the field of the board and along abutting ends.
- B. Align abutting end or edge joints over the web surface of the furring channel. Tie neatly and accurately with end joints staggered.

3.7 CURVED GYPSUM WALLBOARD APPLICATIONS (PER USG #WB-1766)

- A. Gypsum Wallboard: regular thickness of 1/4", 3/8" or 1/2", 48" wide by maximum length practical for the installation. Minimize joints.
- B. Installation: Cut leg and web of top and bottom runners at 2 inch intervals for the length of the arc with 90 degree maximum uniform curve. Fasten 1 inch 18 Mil steel strip inside the cut leg of both runners with USG Metal Lock Fastener. Secure runners to framing in the floor and ceiling. Install studs between runners, twisting them into position, spaced as shown on back of this sheet. Studs may be fastened to runners to lessen their movement. However, if you must allow for deflection, cut studs 3/8 inch less than floor-to-ceiling height and do not fasten to top runner. Anchor to ceiling and floor runners a; studs for shelf-walls and walls adjacent to door/window frames, partition intersections, corners and free-standing furring. Install gypsum panels as follows:

Panel Thickness	1/4"	1/4"	3/8"	3/8"	1/2"	1/2"
Radius	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"
No of studs on Arc, including those at tangents	9	10	9	11	8	9
Approx. O.C. spacing	5.50"	5.93"	7.85"	7.22"	11.70"	11.40"

- C. Cut gypsum board panels so that when applied horizontally they will run a minimum of 1 foot beyond the arc. Wet the side of the panel which, when hung, is in compression. Apply the amount of water as shown above with a garden sprayer. Stack panels with wet sides face to face and cover with plastic sheet. Allow to set for one hour. Install panels on the convex side of the wall first. Begin at one end of the curved surface, wrapping and fastening the panels around the framing. On the concave side of the wall, begin at the center of the curve and work out in both directions. Screw fastener spacing is 12 inches O.C. in single-layer application; 16 inches O.C. for base and 12 inches O.C. for face layer in double-layer application. Allow panels to dry for 24 hours before finishing. Finish face panel joints, internal angles and exposed fasteners with a U. S. Gypsum System applied according to manufacturer's directions.

3.8 WORKMANSHIP TOLERANCES and REQUIRED LEVEL OF FINISH

- A. Wallboard:
- 01 Visual: Correct any nicks, bumps, out-of-level or out-of-plumb areas detectable to the naked eye.
 - 02 Float solid between corner beads less than 36 inches apart. Surfaces that appear concave are not acceptable.
 - 03 Provide "J" mold and continuous 1/4 inch reveal wherever gypsum board directly abuts other material or when the end is exposed.
 - 04 Float control joints flush with the wall surface so that ceiling wall molds that are specified separately will align flat and straight with the wall surface.
- B. Required Level of Gypsum Drywall Finish (refer to Gypsum Association publications for standards):
- 01 All gypsum wallboard shall be finished to a level 4 unless specifically scheduled or noted otherwise. All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with 3 separate coats of joint compound. All joint compounds shall be smooth and free of tool marks and ridges.
 - 02 For all plenum areas and areas not exposed provide a level 1 finish. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
 - 03 All gypsum wallboard scheduled to receive a semi-gloss or glossy finish shall be finished to a level 5 unless specifically scheduled or noted otherwise. All joints and interior angles shall have tape embedded in joint compound and 2 separate coats of joint compound applied over all flat joints and 1 separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with 3 separate coats of joint compound. A thin coat of joint compound or a material manufactured especially for this purpose, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.

3.9 COMMENCEMENT RESTRICTIONS

- A. Interior gypsum wallboard and ceiling board installation may not commence until all exterior sheathing and dampproofing is completed, the individual floor is dried in or roofing is complete, roof top equipment openings are covered and flashed, and exterior wall openings are protected.

3.10 PROTECTION AND CLEAN UP

- A. Coordinate with painting and make sure all gypsum board is primed and the specified texture is provided.
- B. Unless the Construction Manager gives notice otherwise, in advance. Each Trade Contractor is responsible for removing his own trash from the work area and for the initial cleaning of his own work, while ongoing and when completed.
 - 01 Garbage collections: Provide a collection can at each location on the site used as an eating area.
 - 02 Trash removal: Clear the building and site of trash at least once a week. When rapid accumulation occurs, make more frequent removal. Remove highly combustible trash such as paper and cardboard daily.
 - 03 Disposition of debris: Remove debris from the site and make legal disposition. Locations for disposal shall be of the Contractor's choice within the above restrictions. No debris or material may be buried or burned at the site. Take necessary precautions to prevent accidental burning of materials by avoiding large accumulations of combustible materials.
- C. The Work shall be turned over to the Construction Manager/Owner in immaculate condition. Cleaning includes removal of smudges, marks, stains, fingerprints, soil, dirt, paint spots, dust, lint, discolorations and other foreign material.
- D. Remove all temporary facilities.

END OF SECTION

SECTION 09 30 13

CERAMIC TILING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all floor tile products / work as indicated on the Drawings and required for a complete installation.
 - 02 Provide all wall tile products / work as indicated on the Drawings and required for a complete installation.
 - 03 Provide other tile products / work at other locations as indicated on the Drawings and required for a complete installation including metal transitions.
- C. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Section 07 92 00 – Joint Sealants
 - 03 Section 09 21 13 – Gypsum Board Assemblies
 - 04 Section 09 30 16 – Quarry Tiling
 - 05 Refer to other Division 09 Flooring Specifications as required to assure proper coordination and interface at applicable locations.

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements.
 - 05 Shop Drawings shall be sealed and signed by a Texas Registered Engineer.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.

- 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
- 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
 - 04 Composite Sample: Submit samples of selected tile and grout mounted on a minimum 12" x 12" board, or larger if necessary, indicating tile pattern / installation, joint size and grout color.
- G. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.3 REFERENCES

- A. American National Standards Institute:
 - 01 ANSI A108.1 – Installation of Ceramic Tile with Portland Cement Mortar.
 - 02 ANSI A108.4 – Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive.
 - 03 ANSI A108.5 – Ceramic Tile installed with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
 - 04 ANSI/TCA A 108.6 – Ceramic Tile installed with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
 - 05 ANSI A108.10 – Grout Installation.
 - 06 ANSI A118.1 – Dry-Set Portland Cement Mortar.
 - 07 ANSI A118.4 – Latex Portland Cement Mortar.
 - 08 ANSI A118.6 – Specifications for Ceramic Tile Grout.
 - 09 ANSI A136.1 – Organic Adhesives for Installation of Ceramic Tile, Type 1 and Type 2.
 - 10 ANSI A137.1 – Specifications for Ceramic Tile.
- B. Tile Council of North America (TCNA):
 - 01 TCNA Handbook for Ceramic, Glass, and Stone Tile Installation (latest edition).

1.4 WARRANTY

- A. The tile installation, including tile products, mortar adhesives and grout, shall be complete system as recommended by the manufacturer for the specific installation.

- B. Provide a complete systems warranty, issued by the tile setting manufacturer that will cover the entire tile installation system against defects for a minimum ten (10) years.

PART 2 - PRODUCTS

2.1 TILE MANUFACTURERS

- A. Design is based on specific products as manufactured by Dal-Tile as indicated on the Drawings or specified below.
- B. The following manufacturers are acceptable provided the products proposed for use are equal to the basis of design products, including color if specific products as identified on the Drawings and / or finish schedules.
 - 01 American Olean Tile Co.
 - 02 Crossville
 - 03 Florida Tile Industries, Inc.
 - 04 Interceramic Tile and Stone Gallery
 - 05 Texas Cement Products
 - 06 U.S. Ceramic Tile Co.

2.2 TILE MATERIALS

- A. Ceramic Wall Tile:
 - 01 Dal-Tile "Natural Hues", 6" x 12" glazed ceramic tile with cushion edges and Dal-Tile "Miramo", 3, glazed ceramic fan undulated tile, 1/4" thick
 - 02 Provide other sizes, accents and patterns as indicated on the Drawings.
 - 03 Shapes: Provide cove wall tile base, and necessary trim shapes to terminate tile with a bullnose edge at top of partial wall height installations and rounded external corners.
 - 04 Provide square internal vertical corners and ceiling wall joints.
 - 05 Field color shall be from price group 1 or 2.
 - 06 Unless specifically indicated on the Drawings, accent tile shown on Drawings shall be from price group 4 or less.
- B. Porcelain Floor Tile: (PORF-1, PORF-2)
 - 01 Dal-Tile "Volume 1.0" series; or equal approved by the Architect.
 - 02 Color body porcelain tile.
 - 03 Sizes: "12" x 24" as indicated on the Drawings.
 - 04 Dynamic Coefficient of Frictions > 0.42.
 - 05 Patterns shall consist of borders and other patterns as indicated on Drawings.
 - 06 If not specifically identified on the Drawings, a maximum of five colors shall be used.
 - 07 Colors shall be selected by the Architect from manufacturer's complete line of color selections.
 - 08 Provide coved tile base where indicated on the Drawings.
 - 09 At top of all porcelain tile walls not extending to ceiling, tile shall have "glazed over" edge terminated with a bullnose edge tile.
- C. Porcelain Floor Tile: (PORF-3)
 - 01 Dal-Tile "Keystones" series; or equal approved by the Architect.
 - 02 Color body porcelain tile.
 - 03 Sizes: "2" x 2" as indicated on the Drawings.

- 04 Dynamic Coefficient of Frictions > 0.42.
 - 05 Patterns shall consist of borders and other patterns as indicated on Drawings.
 - 06 If not specifically identified on the Drawings, a maximum of five colors shall be used.
 - 07 Colors shall be selected by the Architect from manufacturer's complete line of color selections.
 - 08 Provide coved tile base where indicated on the Drawings.
- D. At top of all porcelain tile walls not extending to ceiling, tile shall have "glazed over" edge terminated with a bullnose edge tile.

2.3 TILE SETTING MATERIALS

- A. Mortar adhesive and grout products shall be furnished by a single manufacturer; and as a system shall be eligible to provide a system warranty.
- B. Acceptable Manufacturers:
- 01 Ardex
 - 02 Cemix / Texrite
 - 03 Custom Building Products
 - 04 Laticrete
 - 05 Mapei Americas
 - 06 Southern Grouts and Mortars
- C. Cement Adhesives:
- 01 Polymer / latex modified, Portland cement based mortar formulated for thin-set tile applications.
 - 02 In accordance with ANSI A118.15.
 - 03 Provide in pre-mixed bags / containers that require only the addition of water.
 - 04 Specific mortar adhesive shall be as recommended by the manufacturer for the intended application.
- D. Epoxy Tile Adhesives:
- 01 In accordance with ANSI A 118.3
 - 02 Provide where indicated on the Drawings, or required for setting as tile as specified by ANSI A 108.6 Chemical Resistant, Water-Cleanable Tile Setting and Grouting Epoxy.
 - 03 Epoxy mortar shall exhibit excellent non-sag and non-slump properties.
 - 04 Specific mortar adhesive shall be as recommended by the manufacturer for the intended application.
- E. Standard Grout:
- 01 Polymer modified, Portland cement based, sanded grout.
 - 02 In accordance with ANSI A118.7.
 - 03 Suitable for 1/16" to 1/8" joint widths.
 - 04 Color consistency throughout entire installation.
 - 05 Contents / additives to inhibit mold and mildew formulation and growth.
 - 06 Provide in pre-mixed bags / containers that require only the addition of water.
 - 07 Specific grout shall be as recommended by the manufacturer for the intended application.
 - 08 Grout color shall be as selected by the Architect from the manufacturer's full range of color selections.

- F. Epoxy Grout:
- 01 High performance, cement based, epoxy grout.
 - 02 In accordance with ANSI A 118.3.
 - 03 Suitable for 1/8" to 3/8" joint widths.
 - 04 Color consistency throughout entire installation.
 - 05 Contents / additives to inhibit mold and mildew formulation and growth.
 - 06 Provide in pre-mixed bags / containers that require only the addition of water.
 - 07 Specific grout shall be as recommended by the manufacturer for the intended application.
 - 08 Grout color shall be as selected by the Architect from the manufacturer's full range of color selections.
- G. Joint Sealers:
- 01 High performance, single-compound, 100% silicone sealant formulated specifically for ceramic tile and stone applications.
 - 02 In accordance with ASTM C920 - Standard Specification for Elastomeric Joint Sealants, Type S, Grade NS, Class 25.
 - 03 Formulated with fungicides to resist mold and mildew growth.
 - 04 Color consistency throughout entire installation.
 - 05 Specific grout shall be as recommended by the manufacturer for the intended application.
 - 06 Sealant color shall match grout color as selected by the Architect from the manufacturer's full range of color selections.
- H. Crack Isolation Membrane:
- 01 Design is based on Mapei Mapeguard 2 or Dal-Tile Dal-CIM 500EX or as recommended by the manufacturer.
 - 02 Crack isolation membrane shall be included in the system warranty.

2.4 METAL TRANSITION

- A. Design is based on products manufactured by Schluter Systems.
- B. Flooring Transitions: Provide the following at flooring transitions where applicable.
- 01 Schluter Renu – U (AE) Satin Anodized Aluminum Tile floor to concrete, rubber, or LVT.
 - 02 Schluter Renu – TK (AE) Satin Anodized Aluminum Tile floor to carpet.
- C. Wall Transitions: Provide the following:
- 01 Schluter Rondec (AE) Satin Anodized Aluminum Tile – walls and corner edge.
 - 02 Schluter Rondec – DB (AE) Satin Anodized Aluminum Tile walls to epoxy base, tile wall finish, top edge.

2.5 EXTRA TILE

- A. Deliver an unopened box of each color of each type of tile to the Owner at Substantial Completion.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examination: Examine substrates for expansion joints and defects which may affect the work. Do not start work until defects have been corrected. Ensure that surfaces are:
 - 01 Dry, clean, free of oily or waxy films, free of curing compounds.
 - 02 Firm and level within specified tolerances.
 - 03 Minimum of 40°F and rising.
- B. Tile Contractor shall examine preparatory work by others and notify Architect of any imperfections which would affect a satisfactory completion of this tile work.
- C. Verify that slab is free of cracks, waxy or oily films, and is well cured. Absence of such notification shall constitute acceptance of responsibility by tile contractor.
- D. Where required for specified systems warranty, provide preparation materials in accordance with manufacturer's recommendations and installation instructions.

3.2 INSTALLATION

- A. Unless shown otherwise on the Drawings, align joints vertically and horizontally.
 - 01 Where multiple tile sizes are used on the same wall / plane, arrange tiles to align common joints.
- B. Use epoxy adhesive and epoxy grout at all wet locations, including, but not necessarily limited to:
 - 01 Restrooms
 - 02 Shower areas
 - 03 Food service areas.
- C. Coordinate ceramic tile joints to align with wall expansion / control joints in CMU and framed walls.
 - 01 Provide non-grouted, sealed joints in ceramic tile at wall expansion / control joints.
 - 02 At wall expansion joints that are installed with an expansion joint cover, locate ceramic tile joints as required to accommodate the expansion joint cover.
- D. Lay out tile on each wall / plane so that the minimum size tile used is not less than 1/2 tile size.
- E. Where partial tile is required saw-cut to provide straight, flush, smooth edges.
 - 01 Where wall patterns indicated on the Drawings require cut tile (i.e. rotated accent tile, and similar), ease the edges of saw-cut tile.
- F. Provide preformed inside and outside corner tile units where applicable.
- G. Bullnose Tile Locations:
 - 01 Provide bullnose edged tile at the top course of tile that does not extend full height to ceilings.
 - 02 Provide bullnose edged tile at the bottom course of tile that directly above seamless epoxy flooring bases.

- H. Set interior wall tile in accordance with T.C.A. Spec. W-242-19 for gypsum board substrate. Set interior wall tile on CMU in accordance with T.C.A. Spec. W-211-18.
- I. Set floor tile and grout in accordance with T.C.A. Spec. F112-08. (Allow a minimum of 24 hours after tiles is set before grouting.) Slope tile to floor drains.
- J. Form internal angles square.
- K. Install expansion joints in accordance with T.C.A. Publication EJ171-18.
 - 01 Provide expansion joints at maximum 24'-0" O.C., and more often if recommended by the manufacturer for the specific installation.
 - 02 Additionally, align ceramic tile joints to coordinate with wall expansion / control joints.
- L. Joint Sealers:
 - 01 Provide at all inside corners of intersecting tiled walls.
 - 02 Provide at all tiled terminations adjacent to door frames and other built-in assemblies.
 - 03 Sealed joints shall be non-grouted, and sealed continuous.
- M. Clean all tile surfaces upon completion. Protect finish tile work as required from damage by other trades / activities.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL TILE CEILINGS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Ceiling suspension system
 - 02 Acoustical, vinyl covered gypsum board and / or wood ceiling tiles as indicated or scheduled on the Drawings.
 - 03 Acoustical diffusers
 - 04 Fire protection over light fixtures and other ceiling mounted items as required to meet UL designs for fire rated ceiling assemblies.
- C. Related Work:
 - 01 Section 01 11 23 – Code Summary
 - 02 Section 09 21 16 – Gypsum Board Assemblies
 - 03 Section 09 84 16 – Sound Reflective Units
 - 04 Section 09 84 33 – Sound-Absorbing Wall Units

1.2 SUBMITTALS

- A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
 - 04 Provide calculations demonstrating compliance with wind load and other requirements.
 - 05 Shop drawings shall be sealed and signed by a Texas registered engineer.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the work of this contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples
 - 01 Provide two (2) samples of each finish for suspension grid and ceiling tile for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 4" x 4" for acoustical tile, and minimum 8" length of suspension grid; but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. ASTM International (ASTM):
 - 01 ASTM A641/A641M-09a - Zinc-coated (Galvanized) Carbon Steel Wire.
 - 02 ASTM A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
 - 03 ASTM C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 04 ASTM C634-13 - Terminology Relating to Environmental Acoustics.
 - 05 ASTM C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - 06 ASTM C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - 07 ASTM C1396 - Standard Specification for Gypsum Board.
 - 08 ASTM D1779-98 - Adhesive for Acoustical Materials.
 - 09 ASTM E84-15b - Surface Burning Characteristics of Building Materials.
 - 10 ASTM E119-16 - Fire Tests of Building Construction and Materials.
 - 11 ASTM E413-16 - Classification for Rating Sound Insulation.
 - 12 ASTM E580/E580M-14 - Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
 - 13 ASTM E1264-14 - Classification for Acoustical Ceiling Products.
- B. Underwriters Laboratory (UL)
 - 01 Underwriters Laboratory (UL) assemblies as required for the Work.
 - 02 Refer to the Drawings and other Specification sections for locations, UL Designs and requirements for fire rated assemblies

1.4 QUALITY ASSURANCE

- A. Projection Conditions:
 - 01 Do not install acoustical ceiling until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.
 - 02 Maintain temperature at minimum 60 degrees F° and humidity if 40% to 50% prior to, during, and after installation.

1.5 EXTRA STOCK

- A. Deliver two (2) unopened cartons of each type of ceiling board at Substantial Completion to location as directed by Owner.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Design of Acoustical Tile Ceilings is based on the following products / manufacturers
- 01 Suspension System: Armstrong World Industries.
 - 02 Acoustical Tiles: Armstrong World Industries.
 - 03 Wood Ceiling Tiles: Armstrong World Industries.
 - 04 Ceiling Cloud Trim: Armstrong World Industries.
 - 05 Gypsum Board Ceiling Tiles: National Gypsum Company.
 - 06 Suspension Clips: Nitroset Solid Propellant Fastening System
 - 07 Lay-In Sound Diffusers and Reflectors: Kinetics Noise Control
 - 08 Flexible Wall Angles: Trim-Tex
- B. The following manufacturers are acceptable for use for this Section, provided all specified requirements are met or exceeded.
- 01 Donn Products, Inc.
 - 02 USG
 - 03 Chicago Metallic
 - 04 CertainTeed
 - 05 Conwed
 - 06 Acoustical Solutions - Lay-In Sound Diffusers and Reflectors

2.2 SUSPENSION SYSTEMS

- A. Suspension System – Non-Fire-Rated Assemblies – Ceiling Type “A”, Ceiling Type ‘D’:
- 01 Design is based on Armstrong “Prelude ML” Exposed Tee suspension system.
 - 02 Cross Section: 1-1/2” x 15/16”.
 - 03 Standard hot-dipped galvanized steel (ASTM C635).
 - 04 Finish: Factory Pre-Painted - baked polyester.
 - 05 Typical Color: Low sheen satin - White.
 - 06 Non-Typical Color: Low sheen satin – Black. To be used at dark rooms, black-box theaters and other locations as indicated on the Drawings.
 - 07 Provide 9/16” x 15/16” angle molding at interface of all vertical walls. Material to match primary suspension system material(s).
- B. Suspension System –Fire-Rated Assemblies – Ceiling Type “A”, Ceiling Type ‘D’:
- 01 Design is based on Armstrong “Prelude XL Fire Guard” Exposed Tee suspension system.
 - 02 Cross Section: 1-1/2” x 15/16”.
 - 03 Standard hot-dipped galvanized steel (ASTM C635).
 - 04 Finish: Factory Pre-Painted - baked polyester.
 - 05 Typical Color: Low sheen satin - White.
 - 06 Non-Typical Color: Low sheen satin – Black. To be used at dark rooms, black-box theaters and other locations as indicated on the Drawings.
 - 07 Provide 9/16” x 15/16” angle molding at interface of all vertical walls. Material to match primary suspension system material(s).
 - 08 Provide UL approved hold down clips where required by UL Design(s).
- C. Suspension System – Semi-Wet Areas – Ceiling Type “C”:
- 01 Same as suspension systems described above for Type “A” ceiling systems; with aluminum cap.
 - 02 Provide at restrooms, mechanical rooms, and similar locations
 - 03 Verify locations required to be part of a fire-rated assembly.

- D. Suspension System –Wet Areas and Exterior Locations – Ceiling Type B:
- 01 Design is based on Armstrong “AL Prelude Plus XL” Exposed Tee suspension system.
 - 02 Provide at locker rooms, shower rooms, food service areas and exterior locations.
 - 03 Cross Section: 1-1/2” x 15/16”.
 - 04 Aluminum with aluminum cap.
 - 05 Finish: Factory Pre-Painted - baked polyester.
 - 06 Typical Color: Low sheen satin - White.
 - 07 Provide 9/16” x 15/16” angle molding at interface of all vertical walls. Material to match primary suspension system material(s).

2.3 LAY-IN TILES

- A. Acoustical Lay-In Tiles – Non-Fire-Rated Assemblies – Ceiling Type ACT-A:
- 01 Design is based on Armstrong World Industries, Inc. “School Zone Fine Fissured” acoustical ceiling tile.
 - 02 Armstrong no. 1713, square edge, Mineral Fiber with non-directional pattern
 - 03 Size: 24” x 24” x 3/4”
 - 04 Typical Color: White.
 - 05 Non-Typical Color: Low sheen satin – Black. To be used at dark rooms, black-box theaters; and other locations as indicated on the Drawings.
 - 06 Fire Resistive.
 - 07 No added formaldehyde
 - 08 HumiGuard Plus sag resistant.
 - 09 BioBlock+ anti-microbial
 - 10 Minimum NRC: 0.70
 - 11 Minimum CAC: 35 dB
 - 12 Minimum Light Reflectance: 85%
- B. Interior Gypsum Board Lay-In Tiles – Non-Fire-Rated and Fire-Rated Assemblies – Ceiling Type B: (Foodservice Areas)
- 01 Design is based on Armstrong World Industries, Inc. “Kitchen Zone” acoustical ceiling tile meeting USDA/FSIS Guidelines for food production
 - 02 Armstrong no. 673, square edge, Mineral Fiber with smooth pattern
 - 03 Size: 24” x 24” x 5/8”
 - 04 Core: Fire and sag resistant mineral fiber .
 - 05 Size: 24” x 24” x 1/2”
 - 06 Surface Finish: Factory applied vinyl latex paint
 - 07 Color: white.
 - 08 Fire Rating: UL Class A, suitable for use in rated assemblies.
 - 09 HumiGuard Plus sag resistant.
 - 10 BioBlock+ anti-microbial
 - 11 Minimum CAC: 33 dB
 - 12 Minimum Light Reflectance: 89%
 - 13 Durable scrubbable and washable finish, impact and scratch resistant
 - 14 UL labeled, Class A (flame spread 25 or under)
- C. Gypsum Board Lay-In Tiles – Non-Fire-Rated and Fire-Rated Assemblies – Ceiling Type C: (Locker, Toilets)
- 01 Design is based on on Armstrong World Industries, Inc. “Armatuff”
 - 02 Armstrong no. 861, square edge, Mineral Fiber with smooth pattern
 - 03 Core: High strength, sag resistant gypsum board.
 - 04 Size: 24” x 24” x 15/16”
 - 05 Surface Finish: non-directional perforated, medium texture
 - 06 Color: white.

- 07 Fire Rating: UL Class A, suitable for use in rated assemblies.
- 08 HumiGuard Plus sag resistant.
- 09 Inorganic Product resistant to the growth of mold and mildew, Bioblock
- 10 Minimum NRC: 0.50
- 11 Minimum CAC: 35 dB
- 12 Minimum Light Reflectance: 87%
- 13 Durable scrubbable and washable finish, impact and scratch resistant

- D. Acoustical Lay-In Tiles – Non-Fire-Rated Assemblies – Ceiling Type ACT-D:
 - 01 Design is based on Armstrong World Industries, Inc. “Painted Nubby” acoustical ceiling tile.
 - 02 Armstrong no. 1713, square edge, fiberglass substrate with factory applied latex paint
 - 03 Size: 24” x 24” x 1”
 - 04 Typical Color: White.
 - 05 Fire Resistive.
 - 06 No added formaldehyde
 - 07 HumiGuard Plus sag resistant.
 - 08 Mold & Mildew resistant
 - 09 Minimum NRC: 0.85 – 0.95
 - 10 Minimum AC: Up to 190
 - 11 Minimum Light Reflectance: 84%

2.4 OTHER PRODUCTS

- A. Suspension Wire:
 - 01 12-gauge solid, galvanized steel wire in lengths as required to overhead structural elements for the installation of each specific room / area.
 - 02 Maximum Spacing: at 4'-0" O.C. both directions, wrapped tightly at least 3 full turns.
 - 03 Provide a separate hanger wire at each corner of all lay-in light fixtures.
 - 04 Verify and adhere to additional hanger and spacing conditions as required by provisions of Division 16 – Electrical, and UL Designs for rated assemblies.
- B. Suspension Clips
 - 01 Design is based on Nitroset Solid Propellant Fastening System; CLU222.
 - 02 Configuration: Utility Clip Assembly
 - 03 Minimum Size: 7/8" shank length; 1/8" shank diameter.
 - 04 Allowable Loads (based on 4000 PSI concrete) at 3/4" embedment depth:
 - a. Tension: 120 lb.ft.
 - b. Shear: 165 lb.ft.
 - c. 45-Degree: 120 lb.ft.
 - 05 Provide where structural conditions do not facilitate suspension wire fastening directly to steel structure.
 - 06 Fastening to Metal Decks: Allowable only at deck valleys where a minimum of 2-1/2" depth of concrete is present.
- C. Retention Clips:
 - 01 Design of retention clips is based on Armstrong World Industries No. 414 Retention Clip; or equal accepted by the Architect.
 - 02 Provide at locations indicated on the Drawings and / or required by specified UL design.
- D. Ceiling Cloud Perimeter Trim:
 - 01 Design is based on Armstrong Axiom Vector Trim
 - 02 Height: 4"

- 03 Provide in straight or curved sections as required for ceiling clouds indicated on the Drawings.
- E. Shadow Molding:
 - 01 Design is based on USG / Donn MS-174 Shadow Molding.
 - 02 "W" shaped molding producing a 3/8" x 3/8" reveal.
 - 03 Provide at all conditions where lay-in ceilings interface with gyp board ceilings in the same plane.
- F. Curved Ceiling Edge Molding:
 - 01 Design is based on Trim-Tex "Flex-Grid Angle"; No. 8159.
 - 02 "L" shaped molding, nominal 1-1/8" x 9/16.
 - 03 Combination rigid and flexible PVC to adapt to radii as small as 6".
 - 04 Provide at all conditions where lay-in ceilings interface with a curved vertical surface (columns, walls, etc.).
- G. Fixture Covers: Where ceilings are part of a fire-rated assembly and required by the UL design, provide UL conforming acoustical tile covers at light fixtures, and other fixtures / equipment installed through the ceiling plane.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure that walls are flat and wall corners square. Commencing work shall be construed as acceptance of preceding work performed by others, as suitable to receive work specified in this Section.
 - 01 Ceiling wall angles shall be flush with substrate.
 - 02 Maximum deviation from flush shall be 1/16".
- B. Where suspended ceilings interface flush with other work (window / door heads, fur-downs, etc.) verify interfacing work is at correct elevation and suitable for a flush interface. Do not manipulate ceiling system to adapt to non-conforming work.
- C. Ensure that wall control joints are flat and will not cause wall mold to misalign at those locations.
- D. Coordinate all locations of cut tile with Architect in field, prior to commencing work.
- E. Do not install any ceiling tile until all above ceiling inspections and corrections have been completed.

3.2 SUSPENDED CEILING SYSTEMS

- A. General:
 - 01 Ceiling grids shall be centered within each room / area unless clearly indicated otherwise on the Drawings.
 - 02 Ceiling grids shall be located such that cuts at perimeter walls shall be over a half-tile unless clearly indicated otherwise on the Drawings.
 - 03 Ceilings shall be installed level, within a tolerance of 1/8" per 10'-0", non-cumulative.
- B. Suspension Wires:
 - 01 The intent of this specification is for the suspension wires to be wrapped around primary or secondary structural steel components where ever practical. Suspension from bridging is not permitted.

- 02 Suspension wires shall be wrapped over structural steel components and twisted a minimum of 3 times (1080 degrees).
- 03 Maximum suspension wire may be angled up to a maximum of 45 degrees.
- C. Suspension Clips:
 - 01 Suspension clips shall be permitted only where structural steel components do not permit installation per the paragraph above.
 - 02 Architect must approve all locations where suspension clips are proposed to be fastened to metal floor or roof deck.
 - 03 All connections to metal decks shall be made at the valley configuration of the metal deck surfaces.
 - 04 Connection to horizontal valley surfaces of the metal deck shall be minimized; and connections shall be at the angled walls of the deck valleys.
 - 05 Install suspension clips in strict accordance with manufacturer's standards and recommendations, using manufacturer's equipment specifically designed for the purpose.
- D. Attachment of grid members to wall molding with pop rivets is not permitted.
 - 01 Hanger wire at 45 degrees, approximately 10 inches long may be used to tie the grid to the wall above the ceiling to prevent eventual disengagement of the two components.
- E. Install ceiling systems by skilled workmen in accordance with manufacturer's printed instructions, the reviewed shop drawings and reflected ceiling plans.
 - 01 Exposed surfaces of acoustical units shall be level and flush, with all joints straight and true.
 - 02 Cutting and fitting around all items protruding through acoustical ceiling shall be done neatly.
 - 03 Wall angles and edge moldings shall have flush hairline joints, with all corners mitered.
 - 04 Where indicated or required, install retention clips at sides of acoustical panels in accordance with manufacturer's standards and instructions.
- F. Align beams or tees with angle molding at corners, unless authorized by Architect.
- G. Fixture Covers:
 - 01 At required locations, install fixture covers at all light fixtures and other required fixtures / equipment installed in the ceiling grid.
 - 02 Installation shall conform to the specified UL design with respect to configuration, assembly and installation.

END OF SECTION

SECTION 09 61 43

CONCRETE FLOOR SEALER

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION 1 APPLY TO THIS SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

- . Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- A. Scope of Work
 - 00 Provide concrete sealer at all interior rooms / areas scheduled to remain concrete.
 - 01 All mechanical rooms.
- B. Related Work:
 - 00 Section 03 30 00 – Cast-In-Place Concrete

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 00 Include recommended cleaning products and instructions for use.
 - 01 Where applicable, provide recommended maintenance schedules and procedures.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM C156 - Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid Membrane-Forming Curing Compounds for Concrete.
 - 02 ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

- 03 ASTM C1315 - 11 Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

PART 2 - PRODUCT

2.1 MANUFACTURERS

- A. Design is based on products manufactured by Prosoco.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
- 01 Euclid Chemical
 - 02 L.M. Scofield
 - 03 ZEP Manufacturing

2.2 MATERIALS

- A. Design of concrete floor sealer is based on Prosoco DuraSheen Clear Concrete Sealer.
- B. Concrete floor sealer shall be a water based, clear semi-gloss sealer specifically formulated for application on interior concrete.
- C. Performance Test Data:
- 01 Federal EPA VOC.
 - 02 ASTM C1315, Type 1, Class A.
 - 03 ASTM C156.
 - 04 ASTM C309, Type 1, Clear.
- D. Technical Data:
- 00 Specific Gravity: 0.77
 - 01 Total Solids: 32%
 - 02 Wt./Gal.: 7.9 Lbs.
 - 03 Flash Point: >100°F (>38°C)
 - 04 Freeze Point: -8°F (-22°C)
 - 05 VOC Content: Complies with USEPA AIM VOC regulations.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete slabs shall be smooth, dry, and free of any foreign materials.
- B. Apply two coats of specified finish in strict accordance with manufacturer's instructions.
- C. Allow approximately 24 hours drying time between installations of coats. Do not apply second coat until Architect has observed the first coat application.
- D. Install coating after all painting operations are completed.
- E. Apply any painted stripes or graphics indicated on Drawings. Allow approximately 24 hours drying time between installation and additional coats.

- F. Apply two (2) additional coats of concrete floor sealer over any areas receiving striping or graphics as specified above. Total for striped areas is 4 coats.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide Luxury Vinyl Tile as indicated or scheduled on the Drawings.
 - 02 Provide Resilient Cove Base as indicated or scheduled on the Drawings.
 - 03 Provide transition trim between different flooring types.
- A. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Division 9 – All other flooring specifications.

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 8" x 8" but must be large enough to convey attributes of the proposed product.

1.2 REFERENCES

- A. ASTM International:
 - 01 ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces.
 - 02 ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
 - 03 ASTM E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 04 ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 05 ASTM F 925-13 - Standard Test Method for Resistance to Chemicals of Resilient Flooring.
 - 06 ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading.
 - 07 ASTM F1515 - Standard Test Method for Measuring Light Stability of Resilient Flooring by Color Change.
 - 08 ASTM F 1700 - Standard Specification for Solid Vinyl Tile.
 - 09 ASTM F 1861 - Standard Specification for Resilient Wall Base.
 - 10 ASTM F 1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 11 ASTM F1914 - Standard Test Methods for Short-Term Indentation and Residual Indentation of Resilient Floor Covering.
 - 12 ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes.
- B. National Fire Protection Association (NFPA):
 - 01 NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 02 NFPA 258 - Standard Test Method for Measuring the Smoke Generated by Solid Materials.

1.3 QUALITY ASSURANCE

- A. Deliver materials in good condition to the job site in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing.
 - 01 Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.4 PROJECT CONDITIONS

- A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F and a maximum temperature of 85°F for at least 48 hours before, during, and for not less than 48 hours after installation.
- B. Thereafter, maintain a minimum temperature of 55°F in areas where work is completed.
- C. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

- D. Slab Moisture Content:
 - 01 Provide RH testing of floor slab in accordance with manufacturer's standards and directions.
 - 02 Flooring specifications are based on RH levels at 95% or less.
 - 03 Where slab RH exceeds 95%, provide manufacturer's enhanced adhesives designed for RH levels in slab.

1.5 WARRANTY

- A. Resilient Flooring System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace system (subfloor preparation products, adhesive, and floor covering) that fails within the warranty period.
- B. Warranty Period: Twenty (20) years.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE MANUFACTURERS

- A. Design of luxury vinyl tile (LVT) resilient flooring based on products manufactured by Tarkett Flooring Inc.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provide all proposed products meet or exceed the specified requirements. Additionally, the products proposed for use are equal to the basis of design products, including color if specific products as identified on the Drawings and / or finish schedules. Submit proposed product for review and acceptance by Architect during bidding / proposal phase.
 - 01 Armstrong
 - 02 Aspecta
 - 03 Forbo
 - 04 Karndean
 - 05 Mannington
 - 06 Mohawk

2.2 GENERAL

- A. Physical Properties:
 - 01 Classification: ASTM F1700 Class III Type B.
 - 02 Total Thickness: 0.120".
 - 03 Wear Layer Thickness: 30 mil minimum.
 - 04 Edge Treatment: Square.
- B. Physical Performance:

01	Flexibility:	ASTM F137	Pass
02	Static Load:	ASTM F970	Pass
03	Residual Indentation:	ASTM F1914	Excellent
04	Flammability:	ASTM E648	NFPA Class 1
05	Slip Resistance:	ASTM D2047	Pass / ADA Compliant
06	Smoke Density:	ASTM E662	<450
07	Chemical Resistance:	ASTM F925	Excellent
08	Resistance to Light:	ASTM F1515	Excellent

2.3 LUXURY VINYL TILE

- A. Product is based on Tarkett Luxury Vinyl Tile and Planks, as indicated on Drawings or approved equal.
- B. LVT Rectangle Tile:
 - 01 12" x 24" x 3.2 mm with 30 mil wear layer.
 - 02 Refer to drawings for location and pattern details.
 - 03 Used at all locations unless noted 'plank' on the finish schedules.
 - 04 Color as selected by the Architect from manufacturer's full range of selections.
- C. LVT Planks:
 - 01 7.25" x 48" & 9" x 59" x 3.2mm with 30 mil wear layer.
 - 02 Refer to drawings for locations and pattern details.
 - 03 Color as selected by the Architect from manufacturer's full range of selections.
- D. LVT Colors:
 - 01 There may be up to five (5) different colors selected.
 - 02 Colors shall be selected by the Architect from the manufacturer's full range of color selections.
 - 03 Architect shall furnish schedule indicating specific locations of each color selected.
- E. LVT Patterns:
 - 01 Provide LVT tile patterns as indicated on the Drawings.
 - 02 All patterns shall be composed of full tile sizes, except edge conditions, unless indicated otherwise on the Drawings.
 - 03 Architect shall furnish Detailed Drawings indicating specific locations of each patterns.
- F. LVT Adhesive:
 - 01 Provide manufacturer's recommended adhesive for the specific installation of the project.
 - 02 Adhesive shall be rated for use for slab RH levels of at least 95%.

2.4 RESILIENT RUBBER MANUFACTURERS

- A. Design of resilient materials is based on specific products, finishes and colors as manufactured by Roppe as identified on the Drawings.
- B. Design of stair tread / riser flooring is based on products manufactured by Nora Systems, Inc.
- C. Design of metal transitions is based on specific products, finishes and colors as manufactured by Schluter Systems as identified on the Drawings.
- D. The following manufacturers are acceptable provided the products proposed for use are equal to the basis of design products, including color if specific products as identified on the Drawings and / or finish schedules.
 - 01 Burke-Mercer

- 02 Flexco
- 03 Johnsonite
- 04 Nora Rubber Co.
- 05 R.C. Munson

2.5 RESILIENT MATERIALS

- A. Base:
 - 01 Design is based on Roppe Pinnacle Rubber Cove base.
 - 02 Quality Standard. ASTM-1861-98, Type TS 100% rubber base with matching end stops and molded corner units.
 - 03 Type. Top-set cove; standard toe.
 - 04 Length: 48".
 - 05 Height. 4" inches, unless shown otherwise.
 - 06 Thickness. Full 0.125.
 - 07 Color. As selected by Architect from manufacturer's standard colors.
- B. Resilient Reducer Strips:
 - 01 1" wide x 1/8" thick, rubber, tapered or bullnose edge, color as selected by Architect from manufacturer's standard colors.
- C. Stair Tread:
 - 01 Design is based on Nora Rubber Series 46'X' Stair Tread with Raised Circular Pattern.
 - 02 One-piece nosing, tread-riser rubber stair tread.
 - 03 Provide in continuous width to cover tread width
 - 04 The top surface shall have raised round pastrilles.
 - 05 The bottom surface shall be flat back, sanded for maximum adhesion.
 - 06 The bottom surface shall be curfed / serrated at tread to riser transition to form a clean 90 degree transition.
 - 07 Provide matching material with raised circular pattern at landings, unless indicated or scheduled otherwise on the Drawings.
 - 08 Color. As selected by Architect from manufacturer's standard colors.
- D. Primers and Adhesives:
 - 01 Concrete Slab Primer: Non-staining type as recommended by material manufacturers.
 - 02 Adhesives: Waterproof, stabilized type as manufactured by resilient material manufacturer.
 - 03 Adhesives shall be capable of use on concrete slabs with 95% Relative Humidity (RH).

2.6 METAL TRANSITION MATERIALS

- A. Design is based on products manufactured by Schluter Systems.
- B. Flooring Transitions: Provide the following flooring transitions where applicable:
 - 01 Porcelain Tile to LVT: Model Reno EU or Schiene.
 - 02 Porcelain Tile to carpet: Model Reno ETK.
 - 03 Carpet to LVT: Model Vinpro-S
 - 04 Carpet to Concrete or LVT to Concrete: Model Vinpro-U series.
 - 05 Provide transitions in sizes appropriate to the interfacing finish flooring materials.

- C. Stair Nosing: Provide the following stair nosing at stair treads with finish flooring materials where indicated on the Drawings:
- 01 Monumental / Open Stairways: Model TREP-E / EK.
 - 02 Stainless steel with slip resistant wear surface.
 - 03 Size: 1-3/16" horizontal surface by 3/8" front edge.
 - 04 Verify exact height required for specific finish floor material installed on stair treads.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Subfloors:
- 01 Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8 inch in 10'-0" variation from level or slopes shown on the Drawings.
 - 02 Prior to laying materials, broom clean or vacuum the surfaces to be covered, and inspect the subfloors.

3.2 INSTALLATION

- A. Install flooring and accessories after the other finishing operations, including painting, have been completed.
- 01 Close spaces to traffic during the installation of the flooring.
 - 02 Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.
- B. Installing Resilient Tiles:
- 01 Place units with adhesive cement in strict compliance with the manufacturer's recommendations.
 - 02 Butt units tightly to vertical surfaces, nosings, edgings, and thresholds.
 - 03 Scribe, as necessary, around obstructions and to produce neat joints.
 - 04 Place tiles tightly laid, even, and in straight parallel lines.
 - 05 Extend units into toe spaces, door reveals, and in closets and similar spaces.
 - 06 Lay units from center marks established with principal walls, discounting minor offsets, so that units at opposite edges of the room are of equal width.
 - a. Adjust as necessary to avoid use of cut widths less than 3 inches wide at edge of space.
 - b. Lay units square to axis of the room or space.
 - 07 Match units for color and pattern by using materials from cartons in the same sequence as manufactured and packaged.
 - 08 Lay in alternating pattern with grain in all units running 90 degrees from adjacent unit.
 - 09 Place resilient edge strips tightly butted to units and secured with adhesive, providing at all unprotected edges, unless otherwise shown.
- C. Installing Base:
- 01 Install base on solid backing. Adhere tightly to wall and floor surfaces.

- 02 Use factory-preformed exterior corners, and factory preformed or job-mitered interior corners.
- 03 Scribe and fit to doorframes and other obstructions.
- 04 Install base on all casework as shown, unless otherwise noted.
- 05 Provide "Liquid Nails" adhesive at all transitions.

D. Installing Stair Treads:

- 01 Thoroughly clean steel and concrete surfaces of stair treads / landings as required for proper adhesion of flooring in accordance with manufacturer's standards and instructions.
- 02 Install stair treads on solid backing. Adhere tightly to tread and riser floor surfaces.
- 03 Take special care at tread-to-riser transition to form a clean 90 degree transition.

3.3 CLEANING AND PROTECTING

- A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

3.4 EXTRA STOCK

- A. Deliver to the Owner for his future use an extra stock of the following:
- 01 Resilient Tile: two (2) unopened boxes of each color and pattern of tile installed, and a one gallon container of adhesive.
 - 02 Resilient Base: two (2) unopened boxes of each color of rubber base installed, and a one quart container of adhesive.
 - 03 Stair Treads: two (2) unopened boxes of each color and pattern of stair treads installed, and a one quart container of adhesive.

END OF SECTION

SECTION 09 68 19

CARPET (FACTORY APPLIED ADHESIVE)

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Furnish and install all carpet as indicated.

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Shop Drawings to the Architect showing layout of all seams and cross seams, location, and type of carpet accessories.
- C. Certificate showing manufacturer's loom on which carpet will be produced, and date of last inspection for specification tolerances.
- D. Samples showing manufacturer's matching color (12" x 12"). Actual base and accessory samples.
- E. Actual sample from loom to produce run of carpet.
- F. Manufacturer's product data including base adhesive.
- G. Maintenance instructions.

1.2 WARRANTY

- A. Manufacturer shall warrant the carpeting for fifteen (15) years against the following defects:
 - 01 Dimensional stability including curling.
 - 02 Edge ravel.
 - 03 Delamination of backing.
 - 04 Wear in excess of 10% by weight.
- B. Manufacturer shall warrant that the generation of static electricity shall not exceed 3.5 KV at 70°F at 20% RH for the life of the carpet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Tandus (division of Tarkett).
- B. Or Approved Equal.

2.2 MATERIALS

- A. Provide carpet free of any irregularities in weave or materials, and each color of one dye lot. Carpet shall be moth and vermin-proof, and pre-shrunk carpet.
- B. Floor Carpeting Abrasive Action II 02578:
 - 01 Width: 6 feet roll goods (powerbond cushion) glue down
 - 02 Surface Texture: Accuweave Pattern Loop
 - 03 Total Thickness: .385 inch
 - 04 Face Weight: 24 Oz.
 - 05 Average Pile Height: .187 inch
 - 06 Pile Yarn Content: TDX Nylon.
 - 07 Dye Method: 100% Solution Dyed
 - 08 Primary Backing: Synthetic Non-woven.
 - 09 Secondary Backing: Powerbond cushion Backing
 - 10 Flooring Radiant Panel Test: ASTM E648, 0.45 watts per square centimeter or greater.
 - 11 Static Control: 3.5 KV or less at 20% RH and 70°F.
- C. Carpet Accessories and Adhesive:
 - 01 Standard accessories as recommended by the successful carpet manufacturer.
 - 02 Carpet edge shall be vinyl overlap type for glue-down carpet.
 - 03 Adhesive as recommended by carpet manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Deliver carpet to the job site in original mill scrapings, if full rolls. Store carpet raised above floor, under cover, and in well ventilated spaces, as soon as delivered. Protect carpet from damage, dirt, stains, and moisture.
- B. The floor shall be clean and free of any foreign substances, such as wax, paint, oil, etc.
- C. Cracks and holes shall be filled with latex emulsion filler compatible with adhesive.
- D. Any ridges and high spots in concrete surface shall be brought to the attention of the Architect and the General Contractor.

3.2 INSTALLATION

- A. General:
 - 01 Glue directly to floor using no pad and no foam. Roll carpet with a roller to ensure maximum contact at the pressure recommended by the manufacturer.
 - 02 Scribe carpet accurately to all vertical surfaces.
 - 03 Align lines of carpet as woven, using no fill strips less than 15 cm (6") in width, laying all carpet in same direction unless specifically otherwise directed by the Architect.
- B. Seams:
 - 01 Locate seams only where shown on approved Shop Drawings or where otherwise approved by Architect.
 - 02 Fabricate seams by the compression method, using a butt joint, and properly bead and seal. Do not stretch seams.
 - 03 Brush out or roll out air bubbles toward seam.
 - 04 Carefully apply a bead seam adhesive to the cut edge at proper height to lock in tufts and seal edge. Do not use floor adhesive to bead cut edge. Use regular seam adhesive.
- C. Clean-Up:
 - 01 Thoroughly clean all carpet surfaces prior to final acceptance of the carpeted areas by Owner. Leave work in neat, uniform condition, vacuumed and ready for use.
 - 02 Any spillage of adhesive on the face of the carpet shall be removed immediately with a clean-up solvent recommended by the manufacturer.
 - 03 Avoid traffic for at least twelve hours after installation.
 - 04 Carpet contractor shall repair any and all damage done by his workmen.
 - 05 Provide traffic areas with heavy Kraft paper or "Visqueen" to protect against damage and soiling. Provide such protection when directed by the Architect.

3.3 EXTRA CARPET

- A. After completion of the carpet installation, the carpet subcontractor shall provide an additional 3% of total yards installed of carpet (6' wide) to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls which does not include scraps.

3.4 GUARANTEE

- A. The carpet installer shall be required to re-lay any carpet that does not provide an attractive wrinkle-free appearance and shall correct any condition due to faulty installation which may appear for a period of one (1) year from date of Substantial Completion.

END OF SECTION

SECTION 09 73 00

WALL PROTECTION SYSTEM

CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS AND DIVISION 1 APPLY TO THIS SECTION

PART 1 – GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide wall protection systems as indicated or scheduled on the Drawings.
 - 02 Wall protection system shall be complete, including trim, and primers and adhesives.
- C. Related Work:
 - 01 Section 09 21 16 – Gypsum Board Assemblies
 - 02 Section 10 26 13 – Corner Guards

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's Specifications and literature describing products, installation procedures and routine maintenance, and other data needed to prove compliance with specified requirements.
- C. Shop Drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.
- D. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x8" of the kind proposed for use.
- E. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated.
- F. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type material and accessory as required.

1.3 REFERENCES

- A. National codes (IBC, UBC, SBCCI, BOCA, Life Safety and CA 01350)
- B. American Society for Testing and Materials (ASTM)
- C. Underwriters Laboratories (UL)

1.4 QUALITY ASSURANCE

- A. Installer qualifications: Engage an installer who has no less than three (3) years of experience in installation of systems similar in complexity to those required for this project.
- B. Manufacturer's qualifications: Not less than five (5) years of experience in the production of specified products and a record of successful in-service performance.
- C. Code compliance: Assemblies should conform to all applicable codes including IBC, UBC, SBCCI, BOCA, Life Safety and CA 01350.
- D. Fire performance characteristics: Provide engineered PETG wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM E84 for Class 1 characteristics listed below:
 - 01 Flame spread: 25 or less
 - 02 Smoke developed: 450 or less
- E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476.
- F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D543.
- G. Color match: Provide wall protection components that are color matched in accordance with the following:
 - 01 Delta Ecmc of no greater than 1.0 using CIELab color space. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present.)
- H. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Store materials in original, undamaged packaging in a clean, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.
- C. Materials must be stored flat.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. The design of wall protection systems is based on products manufactured by Construction Specialties, Inc. (CSI).
- B. Acceptable Manufacturers: the following manufacturers are acceptable to provide products of this section provided proposed products meet or exceed all specified requirements.

- 01 Koroseal
- 02 Pawling
- 03 Inpro / IPC

2.2 PRODUCTS

- A. Design of wall protection systems is based on Construction Specialties Acrovyn 4000 series wall protection system.
- B. Sheet Material:
 - 01 Rigid sheet should be high impact engineered PETG plastic.
 - 04 Nominal .060" thickness and supplied in 4' x 8' or 10' sheet sizes in standard Suede texture.
 - 05 Color shall be as selected by the Architect from manufactures full range of colors and textures including all woodgrains and metal looks.
- C. Accessories:
 - 01 Provide Color Match caulk
 - 02 Provide matching plastic trim at vertical joints.
 - 03 Provide bumper rail at top of panels that coordinate with corner guard assemblies.
- D. Wall protection system shall be furnished as a complete packaged system, containing all primers and adhesives as recommended by the manufacturer for this specific use.
 - 01 Primer and adhesive materials shall be water based and nonhazardous

PART 3 – EXECUTION

3.1 PREPARATION AND INSTALLATION

- A. Materials must be acclimated in an environment of 65°F to 75°F (18°C to 24°C) for at least 24 hours prior to beginning the installation.
- B. Installation areas must be enclosed and weatherproofed before installation commences.
- C. Relative humidity shall not exceed 80%.
- D. Do not expose wall covering to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.
- E. Install the Work of this Section in strict accordance with the manufacturer's recommendations using approved adhesive.

3.2 CLEANING AND PROTECTING

- A. General: Immediately upon completion of installation, clean wall covering and accessories in accordance with manufacturer's recommended cleaning method. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.
- B. Remove surplus materials, rubbish and debris resulting from installation as Work progresses and upon completion of Work.

- C. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.
- D. Do not expose wall covering to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.

END OF SECTION

SECTION 09 77 83

CEMENTITIOUS WOOD FIBER WALL PANELS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work: Provide cementitious wood fiber wall panels where indicated on the Drawings.
- C. Related Work:
 - 01 Section 03 51 13 – Cementitious Wood Fiber Decks
 - 02 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

- A. Product Data: Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
- B. Shop Drawings: Complete Shop Drawings for the Architect's approval.
- C. Manufacturer's installation instructions.
- D. Samples of actual material proposed to be furnished.

1.3 REFERENCES

- A. American Society for Testing Materials:
 - 01 ASTM C423-77.
 - 02 ASTM E84-77a.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Carefully protect Work during shipment, storage and installation.
- B. Deliver materials to job site and store elevated above floor in an enclosed space with proper ventilation and protection from damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. "Tectum" by Tectum, Inc.
- B. "Fibroplank" by Martin Fireproofing Corp.

- C. "Permadeck" by Concrete Products, Inc.

2.2 MATERIALS

- A. Panel (Wood Fiber):
 - 01 Material: Wood fibers bonded with inorganic, hydraulic cement binder or Portland cement binder, and molded under pressure.
 - 02 Size: As indicated on drawings, 2" or 4" thick.
 - 03 Beveled edges.
 - 04 Acoustics: NRC of 0.55 to 0.65.
 - 05 Coating, Treatment: Factory applied primer or sealer required for bottom surface so field painting can be accomplished in one coat, without excessive build-up of paint. Light reflectance 60% prior to field painting. Factory applied asphalt felt membrane face.
 - 06 Fire Rating: Non-combustible per FS SS-S-118A, Type IX, Class 25, in accordance with American Insurance Association, and as listed in UL "Building Materials List".

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not install until space is an air-conditioned environment.
- B. Panels shall be installed with two-piece Z-type brackets mechanically fastened to back of panels and substrate walls per manufacturer's instructions.
- C. Panels shall be field painted.

END OF SECTION

SECTION 09 84 33

SOUND-ABSORBING WALL UNITS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide sound-absorbing acoustical wall panels in sizes and configurations as indicated on the Drawings.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 09 21 16 – Gypsum Board Systems

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

- 03 Minimum size shall be 2" x 2", but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. American Society for Testing Materials:
 - 01 ASTM C423-77 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 02 ASTM E84-77a - Standard Test Method for Surface Burning Characteristics of Building Materials

1.4 QUALITY ASSURANCE

- A. Provide acoustical panels of each type required from one manufacturer, of uniform texture and color.
- B. Installer: Provide evidence of appropriate experience in system installation, and that installation method proposed is acceptable to panel manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Carefully protect work during shipment, storage and installation.
- B. Deliver materials to job site and store elevated above floor in an enclosed space with proper ventilation and protection from damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of sound absorbing, fabric wrapped panels is based on products manufactured by Conwed / Owens Corning.
- B. The following manufacturers of sound absorbing, fabric wrapped panels are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 Acoustical Resources, Inc.
 - 02 Acoustical Surfaces, Inc.
 - 03 AVL Systems, Inc.
 - 04 Decoustics
 - 05 MBI Products
 - 06 Sonotrol
 - 07 Sound Concepts
 - 08 Sound Solutions, Inc.
 - 09 Wall Technology, Inc.
- C. All acoustical panel fabric shall be Guilford of Maine.
 - 01 Color as selected by Architect from manufacturer's full range of fabric selections.

2.2 MATERIALS

- A. Acoustical Panel Type 1 (all panels over 7 feet above finish floor): Design is based on Conwed Respond A Series acoustical panels.
 - 01 Fiberglass core: 7 PCF with chemically-hardened edges.
 - 02 Edge Configuration: Beveled

- 03 Fabric: Gilford of Maine, color as selected by Architect from manufacturer's full range of color selections.
 - 04 Fire Rating: Class A ASTM E84; flame spread shall be less than 25.
 - 05 Attach with manufacturer's clip system for permanent wall mounting. Provide alternate fastening where top clearance is 0".
 - 06 Sizes shall be as indicated on Drawings.
- B. Acoustical Panel Type 2 (all panels under 7 feet above finish floor): Design is based on Conwed Respond IR Series acoustical panels.
- 01 Fiberglass core: 7 PCF with chemically-hardened edges.
 - 02 Semi-rigid glass fiber core faced with 1/8" layer of 16 to 20 PCF molded glass fiber.
 - 03 Edge Configuration: Beveled
 - 04 Fabric: Gilford of Maine, color as selected by Architect from manufacturer's full range of color selections.
 - 05 Fire Rating: Class A ASTM E84; flame spread shall be less than 25.
 - 06 Attach with manufacturer's clip system for permanent wall mounting. Provide alternate fastening where top clearance is 0".
 - 07 Size shall be as indicated on Drawings.
- C. Acoustical Panel Thicknesses
- 01 Band, Choir, Orchestra and Associated Practice Rooms: 4" thick.
 - 02 Other Locations as Indicated on the Drawing: 2"
- D. Attachment:
- 01 Attach with manufacturer's standard panel clip to Z-bar system for permanent wall mounting.
 - 02 Provide alternate fastening where top clearance is 0".

PART 3 - EXECUTION

3.1 PREPARATION

- A. Store in a dry, elevated location in air conditioned environment.
- B. Field verify all dimensions as required to assure accurate fit / installation of acoustical wall panels without modifying in the field.

3.2 INSTALLATION

- A. Install panels only after all wet work has been completed, and temperature conditions (approximate conditions), when space will be occupied.
- B. Install panel plumb, in proper alignment, and in strict accordance with manufacturer's instructions and approved Shop Drawings. Shim wall track as necessary to provide a level frame work, provide spot adhesive to secure panels from movement if clip installation methods are used.
- C. Arrange wall panels symmetrically on each wall, unless otherwise indicated. Lay out so that no panel is less than one-half the width of the typical panel, unless otherwise indicated on Drawings.
- D. Remove and replace panels which are damaged and unacceptable to Architect.

END OF SECTION

SECTION 09 91 00

PAINTING AND RE-PAINTING - SW

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Work under this Section includes furnishing all labor, material, equipment and accessories necessary for completion of all painting and staining.
 - 02 Refer to Paragraph 3.1 for list of items to receive paint.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 05 50 00 – Metal Fabrications
 - 03 Section 09 21 16 – Gypsum Board Assemblies
- D. Work Not Included:
 - 01 Shop coat of paint on metal, unless noted otherwise. Exception: Shop coated / primed metal components which have had primer removed due to repair of the component (i.e. hollow metal doors frames, etc.) shall be re-primed in the field prior to application of finish painting.
 - 02 Aluminum and copper, unless noted otherwise.
 - 03 Factory finished materials, products and equipment.
 - 04 Plastic clad educational equipment.
 - 05 Refer to Section 05 50 00 – Metal Fabrications.

1.1 RESPONSIBILITY OF COORDINATION

- A. Coordinate the Work specified herein with the following Work:
 - 01 Provide information to preceding trades for proper preparation of substrate.
 - 02 Inspect substrate before proceeding to verify proper preparation.
 - 03 Notify Architect of any item to receive paint which may not be covered by a scheduled finish type. Architect will furnish appropriate specification.

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.

- 01 Product data shall include test certificates / reports, other certifications and applicable documentation to demonstrate compliance and as required by the specification.
- C. Samples: Submit full range of colors, patterns, textures and finishes available for selection, including the following:
 - 01 Color Chips: Provide complete duplicate sets of color chips for color selection.
 - 02 Small Applied Samples: Provide pieces of actual material on which paint will occur with minimum dry mil thickness of specified paint.
 - 03 Sheen Samples: Provide full range of varying sheens when sheens are controllable by intermixing.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including preparation, for all products and / or assemblies proposed to be furnished.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Installed Samples: Provide large size samples for approval. Approved samples may be left in place as part of the Work.
 - 01 Interior: One room and/or area, as selected by the Architect, shall be painted with materials specified or accepted and applied directly from container, un-thinned. After acceptance by Architect, room and/or area shall be standard of quality of entire project.
 - 02 Exterior: Three samples, 4'x4' each, of all exterior finishes, provided at the job site. Samples should represent each substrate. After acceptance by Architect, samples shall be standard of quality of entire project.

1.3 QUALITY ASSURANCE

- A. Materials shall be applied directly from containers in which material is purchased. No exceptions.
- B. Subcontractor shall provide to Owner and Architect a notarized certification that paint used is as specified in writing by the Architect.
- C. Number of coats of each of several finishes shall be in accordance with detailed Specifications, which will produce first quality finish if properly applied.
 - 01 If number of coats specified fails to produce a finish acceptable to Architect, this Contractor shall apply additional coat(s) at his own expense until an acceptable finish is achieved.
- D. At painted CMU walls in food service, culinary and other similar health-sensitive areas, the application of the paint system and final finish shall fill voids and irregularities in the CMU and produce a substantially smooth, easily cleanable surface acceptable to the Authority Having Jurisdiction.
- E. Provide primers and other undercoat paints produced by same manufacturer as finish coats. Use thinners recommended by paint manufacturer's printed instructions.

- F. Deliver products to jobsite in unbroken containers bearing manufacturer's labels, intact and legible at time of use.

1.4 WARRANTY

- A. The undertaking of a painting subcontract will indicate that the subcontractor will warrant the Work specified herein for two (2) years against becoming unserviceable or causing an objectionable appearance, resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include by not be limited to the following:
 - 01 Discoloring noticeably by yellowing, streaking, blooming, changing color or darkening.
 - 02 Mildew.
 - 03 Peeling, cracking, blistering, alligating or releasing from the substrate.
 - 04 Chalking or dusting excessively.
 - 05 Changing sheen in irregular fashion.
 - 06 Change in sheen and / or color resulting from re-application of paint using a different application method than use on original coating(s) (i.e. brush touch-up on a surface originally sprayed).
 - 07 Softening or becoming tacky.
 - 08 Bubbling.
- C. In the event of damage, immediately make all repairs and replacements necessary for approval of the Architect, and at no additional cost to the Owner.

1.5 PRODUCT HANDLING

- A. Store only approved materials at the jobsite, storing only in a suitable and designated area restricted to the storage of paint materials and related equipment.
- B. Temperature in the storage area shall be between 40°F and 110°F. Open and mix all materials in the storage area.
- C. Use all means necessary to protect materials before, during, and after application, and to protect the installed work and materials of all other trades.
- D. Apply water-based paints only when temperature of surfaces to be painted, and surrounding air temperatures are between 50°F (10°C) and 90°F (32°C), unless otherwise permitted by paint manufacturer's printed instructions.
- E. Apply solvent-thinned paints only when temperature of surfaces to be painted, and surrounding air temperatures are between 45°F (7°C) and 95°F (35°C), unless otherwise permitted by paint manufacturer's printed instructions.
- F. Do not paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions. Painting may be continued during inclement weather, if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer, during application and drying periods.

1.6 EXTRA STOCK

- A. Upon completion of the Work of this Section, deliver to the Owner, an extra stock equaling 10 percent or a minimum of 1 gallon, whichever is greater, of each color, type, and gloss of paint used in the Work.
 - 01 Make sure each container is tightly sealed, clearly labeled with contents, and location where used.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. All paint materials selected for coating systems for each type of surface shall be the product of a single manufacturer and shall, as a system, have flame spread, fuel contribution, and smoke density test results less than 25.
- B. Paint materials listed herein, unless otherwise designated in the "Painting Schedule", are the products of Sherwin Williams., and require no further approval as to manufacturer or catalogue number.
- C. Similar first line material of one of the following manufacturers may be used subject to approval by the Architect for items indicated to be coated with Sherwin Williams materials:
 - 01 Benjamin Moore Co. (Moore)
 - 02 Pratt & Lambert (P&L)

2.2 EXTERIOR PAINT MATERIALS

- A. The following is a Specification of typical exterior painted items and does not specifically include every item that is to receive paint.
 - 01 It should, however, establish type and quality of finish for all items normally included in a complete paint job.
- B. Exterior Galvanized Metal:
 - 01 1 coat – SW Pro-Cryl Universal Water Based Primer B66-310 Series. 2.0 – 4.0 mils DFT.
 - 02 2 coats – SW DTM Acrylic Gloss Coating B66W100 Series. 2.5 – 4.0 mils DFT each coat.
- C. Field Weld Touch-up on Galvanized Metal:
 - 01 1 coat – SW Pro-Cryl Universal Water Based Primer B66-310 Series. 2.0 – 4.0 mils DFT.
 - 02 2 coats – SW DTM Acrylic Gloss Coating B66W100 Series. 2.5 – 4.0 mils DFT each coat.
- D. Ferrous Metals:
 - 01 1 coat – SW Pro-Cryl Universal Water Based Primer B66-310 Series. 2.0 – 4.0 mils DFT.
 - 02 2 coats – SW DTM Acrylic Gloss Coating B66W100 Series. 2.5 – 4.0 mils DFT each coat.
- E. Exterior Wood:
 - 01 1 coat – SW A-100 Alkyd Wood Primer Y24W20. 2.3 mils DFT.
 - 02 2 coats – SW DTM Acrylic Gloss Coating B66W100 Series. 2.5 – 4.0 mils DFT each coat.

- F. Exterior Concrete Masonry Units:
 - 01 2 coats – SW Loxon XP Exterior Waterproofing System A24-1400 Series, 6.4 – 8.3 mils DFT each coat.
- G. Exterior Concrete Tilt-Wall – Smooth Coating:
 - 01 1 coat – SW Loxon XP Waterproofing Coating A24-100 Series, 6.4 – 8.3 mils DFT.
 - 02 2 coat – SW Conflex XL High Build Smooth, A05W00451, 6.0 – 7.5 mils DFT each coat.
- H. Exterior Concrete Tilt-Wall – Medium Textured Coating:
 - 01 1 coat – SW Loxon XP Waterproofing Coating A24-1400 Series, 6.4 – 8.3 mils DFT.
 - 02 1 coat – SW Conflex XL High Build Medium Texture, A05W00810, 9.4 – 11.0 mils DFT.
- I. Exterior Plaster (designated “Acrylic Finish”):
 - 01 1 coat – SW Loxon Conditioner A24-100.
 - 02 2 coats – Sherwin Williams UltraCrete Textured Masonry Topcoat A44 Fine Texture, 6.0 mils DFT.
- J. Exterior Traffic Marking Paint:
 - 01 1 coat – SW Setfast Solventborne Acrylic Traffic Parking Paint, 15.0 mils WFT, 7.2 mils DFT.

2.3 INTERIOR PAINT MATERIALS

- A. The following is a Specification of typical interior painted items and does not specifically include every item that is to receive paint.
 - 01 It should, however, establish type and quality of finish for all items normally included in a complete paint job.
- B. Interior Gypsum Drywall and Ceilings – Enamel Finish:
 - 01 1 coat – SW Promar 200 Zero VOC Latex Primer B28W02600. 1.1 mils DFT.
 - 02 2 coats – SW Promar 200 Zero VOC Latex B24-2600 Series. 1.4 mils DFT each coat.
- C. Interior Gypsum Drywall and Ceilings – Epoxy Finish:
 - 01 1 coat – SW Preprite 200 Latex Primer B28W200. 1.1 mils DFT.
 - 02 2 coats – SW Water Base Catalyzed Epoxy B70 / B60. 3.0 mils DFT each coat.
 - 03 Use at bathrooms, locker rooms, showers, science labs, food service areas, and other moist / wet areas.
- D. Interior Galvanized Metal:
 - 01 1 coat – SW ProCryl Water Based Universal Primer B66-310 Series. 2.0 – 4.0 mils DFT.
 - 02 2 coats – SW ProClassic Waterborne Acrylic S/G Enamel B31W51 Series. 1.4 mils DFT each coat.
- E. Interior Non-Galvanized Metal:
 - 01 1 coat – SW ProCryl Water Based Universal Primer B66-310 Series. 2.0 – 4.0 mils DFT.
 - 02 2 coats – SW ProClassic Waterborne Acrylic S/G Enamel B31W51 Series. 1.4 mils DFT each coat.

- F. On Metal with Shop Coat, use:
 - 01 Touch-up Shop Coat with SW ProCryl Water Based Universal Primer B66-310 Series, 2.0 – 4.0 mils DFT.
 - 02 2 coats – SW Pro Classic Interior Alkyd Semi-Gloss B34 Series.
 - 03 Used for hollow metal door / window frames and miscellaneous steel items.
- G. On steel joists and wood fiber decks:
 - 01 Coordinate with manufacturer for preparation and application on existing assemblies.
 - 02 Prime as required with primer as recommended by the manufacturer for rusting surfaces, peeling paint etc.
 - 03 2 coats - SW Dry Fall - Waterborne Acrylic Dry Fall, B42W1, 3.5 mils DFT each coat.
- H. Interior CMU – Enamel Finish:
 - 01 2 coats - SW Loxon Block Surfacers A24W200. 8.0 mils DFT each coat.
 - 02 2 coats – SW ProClassic Waterborne Acrylic S/G Enamel B31W51 Series. 1.4 mils DFT each coat.
- I. Interior CMU - Epoxy Finish – Wet Areas:
 - 01 2 coats – SW Kem Cati-Coat Filler B42 Series. Total 15 to 25 mils DFT. As required to fill voids and provide a continuous surface.
 - 02 2 coats – SW Water Base Catalyzed Epoxy B70 / B60. 3.0 mils DFT each coat.
 - 03 Use at showers, food service areas, and other moist / wet areas as indicated.
- J. Interior CMU - Epoxy Finish – Dry Areas:
 - 01 2 coats Loxon Block Surfacers A24W200. Total 16 mils DFT as required to fill voids and provide a continuous surface.
 - 02 2 coats – SW Water Base Catalyzed Epoxy B70 / B60. 3.0 mils DFT each coat.
- K. Interior Wood – Enamel:
 - 01 1 coat – SW Preprite Classic Latex Primer B28W101. 1.6 mils DFT.
 - 02 2 coats - SW ProClassic Waterborne Acrylic S/G Enamel B31W51 Series. 1.4 mils DFT each coat.
- L. Interior Wood – Stained Transparent Finish:
 - 01 SW Wood Classics Stain A49 Series. Coordinate with Architect for specific stain color, application and final appearance to be used for each interior wood stained surface.
 - 02 2 coats - SW Wood Classics Polyurethane Varnish A67 Series, 1.7 mils DFT each coat.

2.4 COLORS

- A. Where specific finished paint colors are indicated or scheduled on the Drawings, provide paint colors accordingly.
- B. Where specific finished paint colors are not indicated or scheduled on the Drawings, different colors may be selected for each room, and more than one color may be selected in each room.

- C. Multiple paint colors and / or patterns on a single wall or plane shall be as indicated on the Drawings.
- D. All piping in mechanical rooms shall be painted in their entirety in accordance with the following color schedule:

01	Natural Gas	Orange
02	Domestic Cold Water	White
03	Domestic Hot Water	Pink
04	Heating Hot Water	Red
05	Condenser Water	Green
06	Chilled Water	Blue

PART 3 - EXECUTION

3.1 ITEMS TO RECEIVE PAINT

- A. Generally, all unfinished items that are normally painted in any typical building, including but not limited to the following list:
 - 01 All ferrous metal including exposed steel structure; excluding mechanical and equipment rooms.
 - 02 All exposed exterior steel; including masonry lintels, exposed steel structure, handrails and other exterior steel components.
 - 03 All exterior wood.
 - 04 All interior wood.
 - 05 All conduit, outlet boxes and electrical cabinets exposed within a user occupied rooms; excluding those located in mechanical / electrical rooms.
 - 06 All exposed pipe, plumbing and ductwork, including those located in mechanical rooms.
 - 07 All new metal grilles, except aluminum, unless otherwise indicated.
 - 08 All new exposed gypsum board surfaces, including all mechanical rooms.
 - 09 All exposed exterior concrete masonry units, including all mechanical rooms.
 - 10 All exposed interior concrete masonry units, including all mechanical rooms.
 - 11 All exposed cementitious wood fiber materials at roof deck and walls.
 - 12 Miscellaneous other items which normally require painting or are scheduled to be painted.
 - 13 Consult plans, finish schedule, details and specifications for other trades as all items usually field-painted or finish will be considered as part of the Contract.
 - 14 All new exposed mechanical equipment and electrical equipment.
 - 15 Any other material that is exposed to view that is not prefinished.
- B. All work where a coat of material has been applied must be inspected and approved by the Architect, before application of succeeding specified coat, otherwise no credit for coat applied will be given.
 - 01 Notify Architect when a particular coat has been completed for inspection and approval.
 - 02 Apply coats of material in strict accordance with manufacturer's specifications, except where requirements of these specifications are in excess of manufacturer's requirements. Paint all sight exposed pipe and plumbing, only after all mechanical work and tests have been completed.

3.2 PREPARATION

- A. Preparation of materials shall be in accordance with the manufacturer's standards and / or recommendations for the paint products / systems specified for each material.
 - 01 Field verify all conditions and requirements and coordinate with manufacturer as required for a proper installation.
- B. General: Surface must be clean to ensure adhesion. Remove oil and grease with paint thinner. Wash off dirt with warm soapy water and rinse with clean water. Remove rust by wire brushing or sanding.
- C. Unfinished Surfaces:
 - 01 Wood: Sand smooth and apply one coat of primer undercoat. After primer has dried overnight, putty nail holes and cracks, then spot-prime putty with primer. Again, allow the primer to dry overnight, sand lightly and topcoat.
 - 02 Masonry and Concrete: Remove form release compounds, efflorescence or cement dust on masonry and concrete by etching with a 10% solution of muriatic (Hydrochloric) acid. Power wash surface after etching with clean water, and paint while still damp, but within manufacturer's moisture tolerance. On surface where muriatic acid cannot be used to neutralize the efflorescence, remove the efflorescence by sanding, scraping or wire brushing, and apply a coat of masonry conditioner before painting. Fill voids and pores in concrete masonry and other porous masonry materials with latex block filler and allow to dry overnight before top coating.
 - 03 Iron and Steel: Prime with metal primer and allow to dry overnight before top coating.
 - 04 Galvanized Metal: Prime with galvanized metal primer and allow to dry overnight before top coating.

3.3 APPLICATION

- A. General: Surfaces to be finished must be clean, dry, and free of dirt, oils, loose paint or any other contamination that would adversely affect adhesion, protective properties or appearance of the coating.
- B. Allow exterior paints to dry 72 hours between coats and interior paint to dry 24 hours between coats.
 - 01 Allow all enamels and varnishes to dry 24 hours between coats. If enamel and varnishes are tacky after 24 hours, allow additional time until finish is dry.
- C. Leveling: Apply with proper consistency and quality so paint flows out to a level surface free of brush and roller marks, bubbles, dust, runs, sags, and holidays. Spread evenly.
- D. Appearance: Uniform color, texture and sheen.
- E. Acrylic coating on concrete tilt-wall system to be applied with 1000psi airless sprayer with heavy duty texture gun.
- F. Neatness: Paint shall not be smeared, spattered or run over adjoining colors or materials. Cut-on lines shall be straight.

- G. First coat shall be white, unless otherwise specified.

END OF SECTION

SECTION 10 11 16

MARKER BOARDS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide fixed dry erase marker boards as indicated on the Drawings.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 01 Section 09 21 16 – Gypsum Board Assemblies
 - 02 Section 10 11 23 – Tack Boards

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM E84 - Standard Test Method for Surface Burning Characteristics for Building.
 - 02 Materials ASTM B221 - Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.
- B. American National Standards Institute (ANSI):
 - 01 ANSI Z97.1 Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test.
- C. Porcelain Enamel Institute:
 - 01 PEI-1002 Manual and Performance Specifications for Porcelain Enamel Writing Surfaces.
- D. GreenGuard environmental Institute:
 - 01 GreenGuard Certified. UL2818-2013 Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.

1.4 WARRANTY

- A. All marker boards shall be warranted for 50 years under normal use against material defects, warping, and delamination of laminate facing and becoming unserviceable.
- B. Any defects noted during the warranty period shall be corrected at no cost to the Building Owner. Such corrective work shall include all labor and material for repair, replacement, refinishing and re-hanging as required.
- C. Provide Manufacturer's executed, written 50-year warranty with close-out documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of marker boards is based on products manufactured by Claridge.
- B. The following manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 ASI Group
 - 02 Best-Rite
 - 03 Carolina Specialties
 - 04 Moore Company
 - 05 Nelson Adams
 - 06 Platinum Visual Systems

2.2 FIXED MARKER BOARDS

- A. Design is based on Claridge "LCS3" liquid chalk writing system with magnetic surface.
 - 01 Material: 1/2 inch thick; three components, 24 gauge porcelain enameled on steel face, 1/2 inch core "Duracore", and .015 aluminum sheet backing.
 - 02 Color: Porcelain plus 11096 medium gloss by Alliance.
 - 03 Refer to drawings for elevation, locations, and sizes.
 - 04 Accessories: Provide 12 markers per liquid chalk writing surfaces. Three each black, blue, red and green.
 - 05 All marker boards shall be factory built.
 - 06 Locations: Where indicated on the Drawings.
 - 07 Size(s): As indicated on the Drawings.
- B. Trim:
 - 01 Marker Trough: Similar to Claridge Series 1, Type A, chalk trough under all marker boards.
 - 02 Map Rails: Similar to Claridge Series 1, Type A. Provide map rail across top of all marker boards.
 - 03 Spring Clips: Similar to Claridge No. 76M; provide four (4) per room where marker boards occur.
 - 04 Roller Brackets: Similar to Claridge No. 76 R.B.; provide two (2) at each marker board.
 - 05 Flag Holder: No. 76 F.H.; provide two (2) per marker board.
 - 06 Miscellaneous Trim: Provide closer and end cap pieces at their termination.
- C. Mounting: Mount factory assembled boards with mounting clips only; no adhesive is to be used. Mount all marker boards at 34" AFF to chalk rail.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate with other trades as required for installation of blocking in walls to secure the marker board support brackets.
- B. All marker boards and accessories shall be installed in strict accordance with manufacturer's printed instructions.
- C. Provide all grounds, brackets, anchors, trim, and accessories for a complete installation.

END OF SECTION

SECTION 10 11 23

TACK BOARDS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all tack boards as indicated on the Drawings.
 - 02 Provide all tack strips as indicated on the Drawings.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 09 21 16 – Gypsum Board Assemblies
 - 03 Section 10 11 16 – Marker Boards

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

- F. Color / Finish Samples:
- 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.2 REFERENCES

- A. ASTM International:
- 01 ASTM E84 - Standard Test Method for Surface Burning Characteristics for Building.
 - 02 Materials ASTM B221 - Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.
- B. GreenGuard environmental Institute:
- 01 GreenGuard Certified. UL2818-2013 Standard for Chemical Emissions for Building Materials, Finishes and Furnishings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of tack boards is based on products manufactured by Claridge.
- B. The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
- 01 ASI Group
 - 02 Best-Rite
 - 03 Carolina Specialties
 - 04 Moore Company
 - 05 Nelson Adams
 - 06 Peninsular Slate

2.2 MATERIALS

- A. Factory Built Tack Board (TB):
- 01 Design of tack board is based on Claridge 800 Series Tack Boards.
 - 02 Frame:
 - a. Type 6063 alloy grade aluminum with T5 tempering in accordance with ASTM B221, with 201-R1 satin anodize finish.
 - b. Aluminum frame with 5/8" face trim (Type CO).
 - 03 Tack Surface: Claridge "Fabricork" vinyl plastic mounted on 1/4 inch resilient cork over 1/4 inch hardboard underlayment (1/2 inch total thickness).
 - 04 Patterns and colors as selected by the Architects from manufacturer's full range of standard colors.
 - 05 Size: 48" height by length indicated on the drawings. Where no length is indicated, provide 72" units.
- B. Mounting:
- 01 Mount factory assembled boards with mounting clips only; no adhesive is to be used.
 - 02 Mount all tack boards at 34" AFF.

- C. Stand-Alone Tack Strip:
 - 01 Design is based on Claridge Hang-Tight Rail System 79.
 - 02 Tackable cork strip insert.
 - 03 Insert extrusion at bottom.
 - 04 Size: 2" height; 1-1/8" depth.
 - 05 Length: 96".
 - 06 Quantity / Locations: Provide 96" tack strips as indicated in drawings. Coordinate with Architect for locations in corridors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate with other trades as required for installation of blocking in walls to secure the tack board support brackets.
- B. All tack boards and accessories shall be installed in strict accordance with manufacturer's printed instructions.
- C. Provide all grounds, brackets, anchors, trim, and accessories for a complete installation.
- D. Mount tackable wall surface to wall substrate in strict accordance with manufacturer's standards and recommendations.

END OF SECTION

SECTION 10 12 00

MANUFACTURED DISPLAY CASES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide prefabricated display cases in sizes and locations as indicated on the Drawings.
 - 02 Provide integral lighting, if any, as indicated on the Electrical Drawings.
- C. Related Work:
 - 01 Section 08 80 00 – Glazing
 - 02 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. ASTM International:
 - 01 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 02 ASTM C1048 – Standard Specification for Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
 - 03 ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of display cases is based on products manufactured by Claridge Products and Equipment.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Educational Equipment
 - 02 Platinum Visual Systems
 - 03 Waddell Display Cases

2.2 MATERIALS – RECESSED DISPLAY CASES.

- A. Design of recessed display cases is based on Claridge series 370 Recessed Display and Trophy Cases. *Use for 48" tall cases.*
 - 01 Provide in widths as indicated on the Drawings.
- B. Aluminum:
 - 01 Trim shall be heavy gauge extruded aluminum and shall meet or exceed ASTM B221 alloy standards.
 - 02 Finish to be dark bronze finish.
- C. Wood Cabinet:
 - 01 Fabricate using 3/4" minimum type M2 medium density fiberboard (MDF) surfaced with horizontal grade laminate.
 - 02 Laminate shall be as selected by Architect from manufacturer's full range of standard selections.
 - 03 Depth shall be 24".
- D. Glass:
 - 01 Doors shall be 1/4" clear tempered glass or 1/4" clear laminated safety glass.
- E. Tackable Back Panel: Claridge Fabricork
 - 01 Vinyl covered 1/4" minimum cork surfacing.
 - 02 Color as selected by the Architect from manufacturer's full range of color / pattern selections.
- F. Housing and Trim:
 - 01 3-1/2" extruded aluminum perimeter trim, 370 series
 - 02 Continuous frame with mitered corner.

- 03 Provide 4" aluminum valance behind door assembly at cases designated with interior lighting.
- G. Sliding Door Assembly:
 - 01 Glass doors shall be fully enclosed in an extruded aluminum track frame.
 - 02 Top and bottom tracks with ball bearing rollers.
 - 03 Provide door pattern as indicated on the Drawings.
 - 04 Provide plunger type, keyed locks at doors.
 - 05 Master key all display cases to the same key.
- H. Accessories:
 - 01 Provide continuous shelf standards at 24" O.C. maximum; flush fit.
 - 02 Provide corresponding shelf brackets; provide (4) brackets per standard.
 - 03 At cases designated with interior lighting, provide LED tube type fixtures, spaced to provide even light across the width of the case.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Thoroughly examine rough opening at display cases to determine they are complete and correct for proper installation of display case.
- B. Notify Contractor of any discrepancies and do not proceed until all discrepancies are fully resolved.
- C. At lighted display cases, coordinate with Electrician for proper rough-in and final connection of lighting.

3.2 INSTALLATION

- A. Install display cases plumb and level in strict accordance with manufacturer's installation instructions and recommendations.
- B. Install door assemblies in track system and fully test for proper installation; adjust as needed for smooth operation.
- C. Upon completion of installation, thoroughly clean all surfaces.

END OF SECTION

SECTION 10 14 00

SIGNAGE

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- . Refer to Tomball ISD RFP #950-23, Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- A. Scope of Work:
 - 00 Room identification signs.
 - 01 Exterior wall mounted aluminum letters.
 - 02 Signage for Exterior Openings
- C. Related Work:
 - 01 Section 01 21 00 – Allowances
 - 02 Section 04 20 00 – Unit Masonry
 - 03 Section 09 21 16 – Gypsum Board Assemblies
 - 04 Section 09 72 13 – Digital Vinyl Wallcoverings
 - 05 Section 09 91 00 – Painting and Re-Painting

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 00 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 01 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 00 Include recommended cleaning products and instructions for use.
 - 01 Where applicable, provide recommended maintenance schedules and procedures.

- F. Color / Finish Samples:
 - 00 Provide two (2) samples of each finish for selection by the Architect.
 - 01 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 02 Minimum size shall be 3" x 3", but must be large enough to convey attributes of the proposed product.
- G. Sample / Mock-Up:
 - 00 Provide a full size, completed sample of an interior room graphic sign.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 01 ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 - 02 ASTM E284 Standard Definition of Terms Relating to Appearance of Materials.
 - 03 ASTM E308 Computing the Colors of Objects by Using the CIE System.
 - 04 ASTM E1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation.

1.3 QUALITY ASSURANCE

- A. Work of this Section shall comply with applicable requirements of the Handicapped Accessibility Act of Texas, as codified in Section 7, Article 601b, Vernon's Texas Civil Statutes.

PART 2 – PRODUCTS

2.1 INTERIOR ROOM GRAPHICS AND SIGNAGE

- B. Design of interior room graphics and signage is based on products manufactured by South Texas Graphics.
- C. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Architectural Graphics Products (APG)
 - 02 Corpus Christy Stamp Works
 - 03 Genesis Graphics and Signs
- D. Materials and Fabrication:
 - Core Material: 1/4" acrylic.
 - Face: Horizontal grade plastic laminate.
 - Design: as indicated on the Drawings.
 - Dimensional characters shall be precision-cut from acrylic and chemically welded to the acrylic core through precision cut-outs in laminate face.
 - Characters shall be raised a minimum of 1/32" above the laminate face.
 - Where shown on the design, fabricate to allow for replaceable sliding identification graphic inserted from either side of the sign. Provide a rigid, clear plastic acrylic cover at slot.

All signs shall be furnished with raised Grade II Braille perma-dots in accordance with ADA standards and requirements.

- E. Mounting:
Install interior signage with perimeter of foam tapes and center fill of clear silicone adhesive.
Locate on wall adjacent to strike side of door at consistent height and distance to door frame throughout the building.
Where sign is mounted on a glass surface, provide a solid back-up plate of same color to cover on the reverse side on glass.

2.2 SEQUENTIAL NUMBER PLAQUES FOR ALL EXTERIOR OPENINGS

- A. Design of interior room graphics and signage is based on products manufactured by South Texas Graphics.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Architectural Graphics Products (APG)
 - 02 Corpus Christy Stamp Works
 - 03 Genesis Graphics and Signs
- C. Materials and Fabrication:
Core Material: 1/4" acrylic exterior grade.
Face: Horizontal exterior grade plastic laminate.
Design: as indicated on the Drawings.
Dimensional characters shall be precision-cut from acrylic and chemically welded to the acrylic core through precision cut-outs in laminate face.
Characters shall be raised a minimum of 1/32" above the laminate face.
- D. Mounting:
Install exterior signage with exterior grade double sided tapes.
Locate on interior and exterior of Door or wall as directed by Architect.

2.3 DEDICATION PLAQUES

- A. Design of interior room graphics and signage is based on products manufactured by A.R.K. Ramos Architectural Signs.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Essential Architectural Signs
 - 02 Ornamental Arts Company
- C. Materials and Fabrication:
 - 00 3/4" thick cast aluminum with a brushed aluminum finish and stipple textured dark oxidized background.
 - 01 Plaque dimensions, font style and sizes, and edging as indicated on Drawings.
 - 02 Raised letters in satin finish as shown on the Drawings.
 - 03 The grade 2 Braille shall be an integral part of the casting.

2.4 CAST ALUMINUM LETTERS / GRAPHICS

- A. Design of cast aluminum letters is based on products manufactured by Woodland Manufacturing.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 A.R.K. Ramos
 - 02 Gemini
 - 03 Southwell Company
- C. Cast aluminum letters / graphics shall be used for the school name and 'Delivery' mounted on an exterior wall of the building.
- D. School Name / Signage:
 - 00 Material: Aluminum 319 Alloy.
 - 01 Edge: Square.
 - 02 Case: all capitals.
 - 03 Finish: Powder coat paint in color as selected by the Architect from manufacturer's full range of color selections.
 - 04 School Name: (49) Forty Nine 12" tall letters, Deliveries: (10) Ten 8" Tall Letters
 - 05 Allow up to 18 characters for school name "TOMBALL HIGH SCHOOL CAREER & TECHNOLOGY EDUCATION CENTER" and "DELIVERIES"
 - 06 Mounting: pin mounted with aluminum or stainless-steel studs for mounting to masonry veneer or Metal Panel.
- E. Address Signage / Numbers:
 - 00 Material: Aluminum 319 Alloy.
 - 01 Edge: Square.
 - 02 Finish: Powder coat paint in color as selected by the Architect from manufacturer's full range of color selections.
 - 03 Address: 6" tall letters.
 - 04 Allow up to 6 digits / characters.
 - 05 Mounting: pin mounted with aluminum or stainless-steel studs for mounting to masonry veneer or Metal Panel.

PART 3 - EXECUTION

3.1 INSTALLATION - INTERIOR ROOM GRAPHICS / SIGNAGE

- A. All room graphics shall be firmly affixed to substrate without use of mechanical fasteners.
- B. Mount graphics at a uniform height and distance from adjacent door jamb in accordance with ADA and Texas Accessibility Standards.
- C. Where graphics are mounted on glass, provide a corresponding plastic laminate surfaces graphic blank on the inside of the glass.

3.2 INSTALLATION – CAST ALUMINUM LETTERS / GRAPHICS

- A. Install in strict accordance with manufacturer's installation instructions and recommendations specific to this installation.
- B. Coordinate with Architect for specific location and height of school name mounted on exterior masonry veneer or metal Panel.
- C. Carefully lay out location of mounting studs on masonry veneer or metal panel on building.
01 Drill holes to accept mounting studs per manufacturer's specifications.
- D. Install cast aluminum letters and numbers, firmly fixing mounting studs in place.

END OF SECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide floor mounted overhead braced, solid HDPE plastic toilet partitions in sizes and configurations as indicated on the Drawings.
 - 02 Modify existing floor mounted overhead braced, solid HDPE plastic toilet partitions in sizes and configurations as indicated on the Drawings.
 - 03 Provide floor anchored wall hung, solid HDPE plastic privacy screens in sizes and configurations as indicated on the Drawings.
- C. Related Work:
 - 01 Section 10 44 00 – Toilet, Bath and Laundry Accessories.

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- E. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembly components.

- 02 Show details of shop fabrications, connections and details.
03 Show details of field fabrications, connections and details.
- F. Color / Finish Samples:
- 01 Provide two (2) samples of each finish for selection by the Architect.
02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
04 Provide a sample of each type of hardware associated with toilet partitions.
- G. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.2 REFERENCES

- A. ASTM International (ASTM):
- 01 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
02 ASTM D 1735 - Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus.
03 ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity.
- B. National Fire Protection Association (NFPA):
- 01 NFPA 286 - Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.
- C. Accessibility: Requirements of Americans With Disabilities Act (ADA) and Texas Accessibility Standards.

1.3 WARRANTY

- A. Manufacturers Standard Warranty: For Solid Plastic HDPE Material: Against breakage, corrosion, and delamination for fifteen (15) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Partitions and Hardware: Design is based on products / systems manufactured by ASI / Accurate Partitions Corp.
- B. Other Acceptable Manufacturers: The following manufacturers are acceptable provided products furnished meet or exceed all specified requirements and attributes of the design basis product / system.
- 01 Ampco Products
02 Bradley
03 Comtec
04 Metpar
05 Scranton Products
- C. All components shall be products manufactured / provided by the manufacturer.

2.2 MATERIALS - TOILET PARTITIONS

- A. Design of plastic toilet partitions is based on ASI / Accurate Partitions high density polyethylene (HDPE) solid plastic toilet partitions.
- B. All toilet partitions shall be floor mounted, overhead braced, solid HDPE plastic, and in the dimensions and arrangements indicated on the Drawings.
- C. Panels:
 - 01 Material shall be extruded high-density-polyethylene (HDPE) virgin resin materials in through colors that extend throughout the panel.
 - 02 Minimum Class B Fire Rated. ASTM-84-05.
 - 03 Conforming to requirements of NFPA 286.
 - 04 Doors and panels of compartments shall have a finished thickness of minimum 1 inch with 1/4" radius corners and shall have a uniform flush front appearance.
 - 05 Pilasters and wall posts of compartments shall have a finished thickness of minimum 1 inch with 1/4" radius corners and shall have a uniform flush front appearance.
 - 06 Stiles shall have a concealed leveling device to adjust to sloped floors.
 - 07 Panel Height: 55" panels mounted 14" above the floor; top of partitions nominally 69" above finish floor.
 - 08 Overhead Rail Height: minimum 82" above finish floor.
- D. Compartment Doors:
 - 01 Standard toilet compartment doors shall be 24" wide.
 - 02 Accessible 60" toilet compartment doors shall be 36" wide.
- E. Panel Finish: Color as selected by Architects from manufacturer's full line of colors, textures and patterns.
 - 01 Partition finishes shall include smooth and textured selections.
- F. Toilet compartments / partition enclosures shall meet all requirements of ADA and Texas Accessibility Standards.

2.3 MATERIALS – PRIVACY SCREEN PARTITIONS

- A. Design of plastic privacy screen partitions is based on ASI / Accurate Partitions high density polyethylene (HDPE) solid plastic partitions / products.
- B. All privacy screen partitions shall be pilaster mounted, wall hung, solid HDPE plastic, and in the dimensions and arrangements indicated on the Drawings.
- C. Panels:
 - 01 Material shall be extruded high-density-polyethylene (HDPE) virgin resin materials in through colors that extend throughout the panel.
 - 02 Minimum Class B Fire Rated. ASTM-84-05.
 - 03 Conforming to requirements of NFPA 286.
 - 04 Panels shall have a finished thickness of minimum 1 inch with 1/4" radius corners and shall have a uniform flush front appearance.
 - 05 Pilasters compartments shall the same as compartment panels and shall be minimum 6" wide.

- 06 Panel Height: 55" panels mounted 14" above the floor; top of partitions nominally 69" above finish floor.
- 07 Overhead Rail Height: minimum 82" above finish floor.
- D. Panel Finish: Color as selected by Architects from manufacturer's full line of colors, textures and patterns.
- 01 Partition finishes shall include smooth and textured selections.
- E. Privacy screen partitions shall meet all requirements of ADA and Texas Accessibility Standards.

2.4 MATERIALS – PARTITION HARDWARE AND ACCESSORIES

- A. All door hardware, mounting brackets and support brackets shall be manufacturer's standard products as required for issuance of specified warranty.
- 01 The following hardware Specifications are based on products furnished by ASI / Accurate Partitions.
- 02 Minor variations in hardware from other acceptable manufacturers are allowed, provided the proposed hardware meets or exceeds specified requirements; and meet the intent of the design and performance requirements.
- B. Door Hinges: Shall be a wrap-around, cam-action type hinges.
- 01 Through bolted to pilasters and panels with vandal-proof, stainless steel barrel bolts and fastened to walls with #14x 1-1/2" stainless steel security pins located behind the panel.
- 02 Minimum 2 pair at each door.
- 03 Stainless steel, Type 320 or 304.
- 04 Nominal size: 8".
- 05 Shall provide door return to pre-set position when not in locked position.
- C. Door Strike and Keeper: Shall be fabricated from heavy duty aluminum extrusion (6463-T5 Alloy).
- 01 Through bolted to pilaster with stainless steel barrel bolts. Side bolt and button shall be heavy duty aluminum.
- 02 Shall be configured to provide for emergency access.
- D. Headrails and headrail returns of overhead braced toilet compartments shall be aluminum extrusion (6463-T5 Alloy) with bright-dipped anodized or satin finish.
- 01 Configuration shall be anti-grip profile.
- 02 Headrails and brackets shall be 18-gauge stainless steel.
- E. Wall brackets shall be full length extruded 6063-T5 aluminum brackets and shall be used for all pilasters-to wall, pilaster-to panel and panel-to-wall connections.
- 01 Wall brackets shall be through bolted to pilasters and panels with vandal-proof, stainless steel barrel bolts and fastened to walls with #14x 1-1/2" stainless steel security pins located behind the panel.
- F. All pilasters shall have Type 302/304, 18-gauge stainless steel pilaster shoes anchored to finish floor with minimum #14x1-1/2" stainless steel screws.
- G. Provide all other accessories required for a complete installation as recommended by the manufacturer.

1
2 **PART 3 - EXECUTION**
3

4 **3.1 INSTALLATION**
5

- 6 A. Install in strict accordance with manufacturer's printed instructions.
7
8 B. Install all partitions where indicated on the Drawings, and as indicated on the
9 Shop Drawings. Anchor all components firmly in place for a long life under
10 hard use, and in complete accordance with the manufacturer's
11 recommendations.
12
13 C. Provide blocking/anchoring devices to secure to wall. Anchoring devices must
14 be compatible to wall type to ensure adequate strength.
15
16 D. At drywall construction, treated 2X blocking shall be installed between studs
17 and wall brackets/accessories shall be attached to blocking using 2" coated
18 wood screws at 12" O.C. maximum spacing.
19
20 E. Provide pliable spacers between wall and backside of wall brackets / hardware
21 to prevent crushing of wall finish.
22

23 **3.2 CLEANING AND ADJUSTING**
24

- 25 A. Defaced finish will not be permitted. Damaged, scratched or defective
26 materials will be rejected, and shall be replaced with new materials.
27
28 B. Clean surfaces free of oil and imperfections.
29
30 C. Except for compartments for the handicapped, adjust doors to remain at a
31 uniformly open position when unlocked.
32
33
34
35

END OF SECTION

SECTION 10 22 13

WIRE MESH PARTITIONS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide wire mesh partitions where indicated on the Drawings.
 - 02 Provide wire mesh doors integrated into partition system as indicated on the Drawings.
- C. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Section 04 20 00 – Unit Masonry
 - 03 Section 05 50 00 – Metal Fabrications
 - 04 Section 09 91 00 – Painting and Re-Painting

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
 - 03 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Samples:
 - 01 Provide two (2) samples of wire mesh fabric, minimum 12" x 12".
 - 02 Provide two (2) samples of each finish for selection by the Architect.
 - 03 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

- 04 Minimum size shall be 2" x 2", but must be large enough to convey attributes of the proposed product.

1.3 REFERENCES

- A. ASTM International:
- 01 ASTM A36 - Structural Steel
 - 02 ASTM A123 / A123M – Standard Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.
 - 03 ASTM A153 / A153M - Standard Specifications for Zinc (Hot-Dip) on Iron and Hardware.
 - 04 ASTM A307 - Carbon Steel Externally and Internally Threaded Standard fasteners
 - 05 ASTM A385 - Providing High-Quality Zinc Coating (Hot Dip)
 - 06 ASTM A325 - High Strength Bolts for Structural Steel
 - 07 ASTM A500 - Cold formed welded and seamless carbon sheet structural tubing in rounds and shapes.
 - 05 ASTM A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel
 - 08 ASTM A992 - Steel for Structural Shapes for use in Building Framing
- C. American Institute of Steel Construction:
- 01 Steel Construction Manual, 15th Edition
- D. American Welding Society:
- 01 American Welding Society Structural Welding Code D11.1-77
- E. American Iron and Steel Institute:
- 01 Specification for Design Fabricated and Erection of Cold Formed Steel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of wire mesh partitions is based on products manufactured by Acorn Wire and Iron Works.
- B. The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
- 01 Central Wire & Iron Works
 - 02 Cogan
 - 03 Major Partitions
 - 04 Standard Wire & Steel Works
 - 05 Storage Equipment Company
 - 06 Wire Crafters

2.2 MATERIALS

- A. Design of wire mesh partitions is based on Acorn Wire and Iron Works series 130A Standard Wire Mesh Partition system.
- B. Wire Mesh Partitions:
- 01 Mesh: 1 1/2-inch diamond mesh of not less than 10 gauge wire, complying with ASTM A510.
 - 02 Intermediate Bars: Pair of 1" x 1/2" x 1/8" cold rolled channels bolted together, allowing mesh to pass.

- 03 Vertical Frames: Pair of 1-1/4" x 5/8" 'C' channels with I-beam stiffeners of 5/16" x 2" bars.
 - 04 Horizontal Frames: Pair of 1" x 1/2" x 1/8" channels.
 - 05 Top Caps: 2-1/4" x 1" cold rolled channels.
 - 06 Head Track (sliding): With four-wheel ball bearing trucks.
 - 07 Erection Hardware: As necessary to secure and complete the installation.
 - 08 Floor Shoes: Weldable ductile iron, 1 1/4 inch high, with set screw adjustment.
 - 09 Galvanized steel handrail verticals (1 1/2" diameter), and horizontals with mesh panel inserts as shown on Drawings.
- C. Wire Mesh Doors: Provide sliding doors at the dimensions and arrangements shown on the Drawings and with the following features. Provide swing type doors as indicated on the Drawings.
- 01 Framing: 1 1/4" x 1/2" x 1/8" hot rolled channels, with 1 1/4" x 1/8" flat bar cover on three sides.
 - 02 Provide 1 3/8" x 3/4" x 1/8" angle riveted to lock sides.
 - 03 Provide continuous head track and wheel trucks.
 - 04 Provide a continuous 12-gauge strike bar.
 - 05 Provide cylinder locks at swing gates and sliding doors.
 - 06 Provide 2 pair of heavy-duty hinges per leaf.
- D. Finish:
- 06 All components: Galvanized
 - 07 Provide shop applied prime coat of rust-inhibitive paint compatible with the finish coat provided under Section 09 91 00 – Painting and Re-Painting.
- E. Miscellaneous Materials: Provide other materials not specifically described, but required for a complete and proper installation, as selected by the Contractor, subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

- A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work.
- B. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install the Work of this Section in strict accordance with the manufacturer's recommendations and Shop Drawings.
- B. Set all partitions and components square and plumb.
- C. Anchor all components firmly into position, true to line, and aligned horizontally and vertically.
- D. Adjust operating components for optimum smooth function.

END OF SECTION

SECTION 10 26 13

CORNER GUARDS & CRASH RAIL

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 This section includes the furnishing and installation of polycarbonate corner guards at all painted and vinyl wall covering finished outside corners of drywall partitions.
- C. Related Work:
 - 01 Section 09 21 16 – Gypsum Board Assemblies
 - 02 Section 09 72 00 – Wall Protection System

1.2 SUBMITTALS

- A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Data for each product.
- C. Shop Drawings indicating mounting details and fasteners.
- D. Sample – 18 inches long minimum.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Corner Guards:
 - 01. Corner Guard SM-20N by Construction Specialties (Basis of Design).
 - 02. Corner guards shall be minimum 0.093" thick textured vinyl material.
 - 03. Fire Performance Characteristics: ASTM E84 Class 1, Flame Spread 15.
 - 04. Impact Resistance: 15 ft. lb./ sq. inch as tested per ASTM D256.
 - 05. Size: 2" x 2" x 48", 2" x 2" x 84" and 2" x 2" x 94".
 - 06. Color as selected by the Architect from manufacturer's full range of color selections. Color to match wall protection system.
 - 07. Shape: 90, 45 and 135 degrees, and as required, secured with stainless steel self-tapping pan head screws at 18 inches o.c., vertical both sides.

- 08. Aluminum: Extruded aluminum should be 6063-T6Alloy, nominal .070 thickness, bull height continuous metal retainer. Minimum strength and durability properties as specification in ASTM B221.
- B. Wall Guards:
 - 01. Wall Guard FSC-25N by Construction Specialties (Basis of Design).
 - 02. Wall guards shall be minimum 0.093" thick textured vinyl material.
 - 03. Fire Performance Characteristics: ASTM E84 Class 1, Flame Spread 15.
 - 04. Impact Resistance: 15 ft. lb./ sq. inch as tested per ASTM D256.
 - 05. Size: 48", 84" and 94" lengths.
 - 06. Color as selected by the Architect from manufacturer's full range of color selections. Color to match wall protection system.
 - 07. Aluminum: Extruded aluminum, should be 6063-T6Alloy, nominal .070 thickness, bull height continuous metal retainer. Minimum strength and durability properties as specification in ASTM B221.
- C. Crash Rail:
 - 01. Crash Rail: SCR-40N by Construction Specialties (Basis of Design).
 - 02. 4" H surface mounted crash rail with full aluminum retainer.
 - 03. Refer to Drawings for color selection.
 - 04. Engineered PETG Crash Rail to be Acrovyn 4000 by Construction Specialties (Basis of Design) consisting of a continuous aluminum retainer with snap on Acrovyn 4000 cover and integrals shock absorbing cushion. End caps shall be mechanically fastened with concealed fasteners.

2.2 MANUFACTURERS

- A. Construction Specialties (Basis of Design).
- B. AFCO
- C. Balco, Inc.
- D. Koroseal Wall Protection Systems
- E. Pawling Systems
- F. Or Approved Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Corner Guards: Locate corner guards at all outside corners in corridors.
- B. Anchor for appropriate substrate, and in compliance with the manufacturer's instructions.
- C. Install corner guards level and plumb at the height indicated on the Drawings, with surfaces free from distortion or other defects in appearance.

- D. Cleaning: At completion of the installation, clean surfaces in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10 44 00

TOILET, BATH AND LAUNDRY ACCESSORIES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- . Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Furnish and install toilet and bath accessories as indicated or scheduled on the Drawings or specified herein and at revised existing toilet stalls.
 - 02 GC responsible for Installation of Items Provided by Owner:
 - a. Soap dispensers - surface mounted.
 - b. Roll Paper towels dispensers - surface mounted.
 - c. Toilet tissue dispensers- surface mounted.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 09 21 16 – Gypsum Board Assemblies
 - 03 Section 10 21 13.17 – Phenolic Core Toilet Partitions
 - 04 Section 10 21 13.19 – Plastic Toilet Partitions

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details.
 - 03 Show details of field fabrications, connections, and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.
- D. Operations and Maintenance Manuals
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to section 01 78 23 – Operations and Maintenance Manuals
 - 03 O & M manuals must be reviewed, accepted, and delivered to the Owner prior to Owner demonstration(s).
- E. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

1.2 REFERENCES

- A. ASTM international:
 - 01 ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 02 ASTM A480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
 - 03 ASTM B177 - Standard Guide for Engineering Chromium Electroplating.
 - 04 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide products manufactured by a company with a minimum of ten (10) years successful experience manufacturing similar products.
- B. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.
- C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.
- D. Hazardous Materials: Comply with EU Directive "Restrictions of Hazardous Substances (RoHS) requirements."

1.4 WARRANTY

- A. Provide a written warranty for all provided stainless steel components covering the stainless-steel finish against rust and / or rust spots for a period of two (2) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General design is based on products manufactured by Bobrick.
- B. The following additional manufacturers are acceptable provided proposed products meet or exceed all specified requirements.
 - 01 A & J Washroom Accessories
 - 02 American Specialties
 - 03 Bradley
 - 04 Charles Parker Co.
 - 05 GAMCO, General Accessory Mfg. Co.
 - 06 Watrous, Inc.
- C. Specified products listed by other manufacturers comply with district standards and are listed as no substitutions.

2.2 MATERIALS

- A. Stainless Steel:
 - 01 Alloy: AISI, Type 302 or 304 (18-08) ASTM A167.
 - 02 Finish: No. 4 satin, unless otherwise specified.
 - 03 Thickness: US Stainless 22 gauge minimum.
- B. Aluminum:
 - 01 Extruded: 6463-T5 alloy, anodized.
 - 02 Cast: 356 or 356-T6 alloy.
- C. Chromium Plating:
 - 01 Method: Over nickel.
 - 02 Standard: ASTM B177, Type SC 2.
- D. Brass:
 - 01 Cast or forged.
 - 02 QQ-B-626C.
- E. Mirrors: (Framed)
 - 01 Standard: Federal Standard A-A-3002.
 - 02 Glass thickness: 1/4 inch minimum.
 - 03 Backing: Electrolytic copper.
 - 04 Protection: Padding and filler strips.
 - 05 Frame: Type 304 stainless steel, satin finish.

PART 3 - EXECUTION

3.1 MOUNTING LOCATIONS

- A. Refer to Drawings for mounting locations. When not shown, submit supplier's recommendations for locations and mounting height before proceeding.
 - 01 For Owner Furnished Contractor Installed (OFCI) accessories, coordinate with Owner to obtain cut sheets and mounting instructions for all accessories.

- B. Coordinate with other trades as required for opening sizes for recessed and semi-recessed accessories, installation of blocking in walls, and electrical connections to accommodate the installation of all toilet and bath accessories.
 - 01 All wood blocking shall be treated.
 - 02 Wood blocking shall be sized to accommodate anchorage of toilet accessory and provide minimum toilet accessory weight requirements.
 - a. Grab Bars: 250 LBS
 - b. Shower Seats: 360 LBS.

3.2 INSTALLATION

- A. Install all toilet and bath accessories in strict accordance with manufacturer's standards and recommendations.
- B. Use concealed fastening where possible; and where not possible, use approved theft-resistant type fasteners for anchoring toilet accessories.
- C. Comply with ADA requirements.

PART 4 - SCHEDULES

4.1 ITEM LIST

- A. As a quality standard, model numbers shown are Bobrick Washroom Equipment unless indicated otherwise.
- B. TA-1 – Wall Mounted Soap Dispensers:
 - 01 Owner Furnished - Contractor Installed.
 - 02 Provide one (1) at every single sink location.
 - 03 At multiple / gang sink locations, provide quantities indicated on the Drawings.
 - 04 Mounting: Surface with concealed fasteners.
- C. TA-2 – Mirrors:
 - 01 Bobrick Model No.: Series 290 series stainless steel framed mirror without shelf.
 - 02 Mounting: Surface with concealed fasteners.
 - 03 Sizes Above Lavatories and Sinks: Minimum 24" x 36". Refer to Drawings for other sizes.
 - 04 Full Height Mirrors: Minimum 24" x 72". Refer to Drawings for other sizes.
- D. TA-3 – Paper Towel Dispenser C-Fold:
 - 01 Owner Furnished - Contractor Installed.
 - 02 TORK Mechanical Hand Towel Roll Dispenser – No Substitutions.
 - 03 Provide one (1) at every single sink location.
 - 04 At multiple / gang sink locations, provide quantities indicated on the Drawings.
 - 05 Model No.: 784728, Roll paper towel dispenser, 12.5"H x 11.8"W x 7.5" D, Black.
 - 06 Mounting: Surface with concealed fasteners
- E. TA-5 - Toilet Paper Dispenser - Roll:
 - 01 Owner Furnished - Contractor Installed.
 - 02 Location: One at each toilet.
 - 03 Mounting: Surface with concealed fasteners

- F. TA-6 - Grab Bars – Toilet Compartments:
 - 01 Standard Accessible Stall: Bobrick Model No.: B-6806.99 x 36 and x 42 in each 60" wide standard accessible stall.
 - a. At toilets where flush valve assembly interferes with accessible mounting height of rear grab bar, provide Bobrick model no.: B6806.99 x 12" and x 24" mounted on either side of the flush valve.
 - b. Field verify all conditions.
 - 02 Ambulatory Accessible Stall: Bobrick Model No.: B-6806.99 x 42 (2) in each 36" wide ambulatory accessible stall.
 - 03 Mounting: Surface with concealed fasteners and theft-proof covers.
- G. TA-7 - Mop and Broom Holder:
 - 01 Bobrick Model No.: B-223 x 36, four holders.
 - 02 Mounting: Surface.
 - 03 Location: One at each mop sink, whether indicated or not.
- H. TA-8 - Clothes Hooks:
 - 01 Bobrick Model: B-233.
 - 02 Mounting: Surface (48" AFF).
 - 03 Location: One at each toilet stall door, whether indicated or not and one (1) at single use restrooms mounted on back of solid core wood door and as indicated on drawings.
- I. TA-9 – Feminine Napkin Dispenser:
 - 01 Model No.: B-2800 25.
 - 02 Mounting: Surface with concealed fasteners.
 - 03 Operation: Single coin (25 cents).
 - 04 Capacity: 31 Napkins/22 Tampons.
- J. TA-10 - Feminine Napkin Disposal:
 - 01 Model No.: B-270.
 - 02 Mounting: Surface with concealed fasteners.
 - 03 Liners: Provide 4 dz. liner units, No. B-270-12.2.
- K. TA-11 - Grab Bars – Shower Compartments:
 - 01 Model: B-6806-24 and B-6806-30.
 - 02 Mounting: Surface with concealed fasteners and theft-proof covers.
 - 03 Location: One at each H.C. shower at 33"-36" AFF.
- L. TA-12 - Folding Bench – Shower Compartments:
 - 01 Bobrick Model: B-5181.
 - 02 Mounting: Surface.
 - 03 Location: One at each H.C. shower at 18" AFF to top of bench.
- M. TA-13 - Shower Curtains and Rods:
 - 01 Model No.: B-6047 series, heavy-duty stainless-steel rod.
 - 02 Model No.: B-204 series, vinyl shower curtain (42" or as required).
 - 03 Mounting: Surface with concealed fasteners at 71" AFF.
 - 04 Provide one at each shower stall as indicated on the Drawings. Verify length(s) required.
- N. TA-15 - Electric Hand Dryer:
 - 01 N/A
- O. TA-16 – Baby Changing Station:

- 01 Bobrick / Koala Kare Model: KB-200.
- 02 Polypropylene body with steel hinge system, and complete with liner dispenser and liners.
- 03 Mounting: Surface with concealed fasteners.
- 04 Height above finish floor: 32" to bottom of unit.

- P. TA-17 – Transfer Type Shower Compartment: General designation to identify assembly

- Q. TA-18 – Roll-In Shower Compartment: General designation to identify assembly

- R. TA-19 – Accessible Toilet Stall: General designation to identify assembly

- S. TA-20 – Ambulatory Toilet Stall: General designation to identify assembly

- T. TA-21 – Shower Water Retainer:
 - 01 Design is based on Freedom Showers model APFCWRW3 series Collapsible Water Retainer; or approved equal.
 - 02 Constructed of 1" white neoprene rubber, easily collapsible from foot traffic or wheelchairs.
 - 03 Provide with squared endcaps to fit against adjacent wall surface.
 - 04 Installed with self-adhesive, double-sided epoxy tape.
 - 05 Provide at all roll-in showers whether shown or not.
 - 06 Provide in length to fill full opening of shower, wall to wall.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide fully recessed fire extinguisher cabinets where indicated on the Drawings.
 - 02 Fire extinguishers shall be GC Furnished installed.
 - 03 Provide fire extinguisher wall brackets at all mechanical rooms, main electrical room and central plant.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 09 21 16 – Gypsum Board Assemblies

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

- F. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes.
- G. Operations and Maintenance Manuals
 - 01 Provide complete operations and maintenance manuals to the Owner.
 - 02 Refer to section 01 78 23 – Operations and Maintenance Manuals
 - 03 O & M manuals must be reviewed, accepted and delivered to the Owner prior to Owner demonstration(s).
- H. For warranties longer than one (1) year, submit a sample of the warranty proposed to be furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of fire extinguisher cabinets and fire extinguishers is based on products manufactured by JL Industries.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Apex
 - 02 Potter Roemer
 - 03 Uline

2.2 MATERIALS

- A. Fire Extinguisher Cabinets: Design is based on JL Industries Cosmopolitan Series, semi-recessed cabinets with 1-1/2" projection, model number 1836V – Vertical Duo.
 - 01 24" x 10- 1/2" x 5-1/2" inside box dimension.
 - 02 Semi-recessed type with 1-1/2 inch return trim, square edge with eased corners.
 - 03 Stainless steel door with handle and silk-screened lettering "Fire Extinguisher" with wire glass.
 - 04 Hinge: Concealed.
 - 05 Provide a handle and magnetic catch with keyed lock.
 - 06 Finish of Exterior: Stainless steel.
 - 07 Finish of Interior: Standard.
 - 08 All fire extinguisher cabinets shall be furnished with 10 lb. fire extinguisher.
- B. Wall Mount Brackets:
 - 01 Provide manufacturer's standard fire extinguisher wall bracket specifically suited for support of wall mounted fire extinguishers.
- C. Fire Extinguishers (Standard):
 - 01 Multi-purpose dry chemical with UL 4A-60B:C and FM approved; UL 2A-10B:C for 5 and 10 lbs.

- 02 Capacity: 5 lb. At mechanical rooms and direct wall mounted extinguishers; and 10 lb. at fire extinguisher cabinets.
- 03 Extinguishers are furnished for direct wall mounting and for fire extinguisher cabinets. Refer to Drawings for location and quantity.
- 04 Provide initial inspection tag for each extinguisher.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate with other trades as required for installation of rough openings / recesses in walls to receive fire extinguisher cabinets.
- B. Coordinate with other trades as required for installation of all blocking in walls necessary for proper installation of fire extinguisher cabinets and wall mounted brackets.

3.2 INSTALLATION

- A. Install fire extinguisher cabinets in strict accordance with manufacturer's standards and final reviewed submittals.
- B. Install fire extinguishers at all cabinets and wall hung locations.
- C. Provide initial inspection tag for each extinguisher immediately prior to Substantial Completion.

END OF SECTION

SECTION 10 51 13.13

METAL LOCKERS AND WOOD BENCHES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide Heavy Duty metal lockers in quantities and locations as indicated on the Drawings.
 - 02 Provide wood benches in quantities and locations indicated on the Drawings.
- C. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Section 04 20 00 – Unit Masonry
 - 03 Section 09 21 16 – Gypsum Board Assemblies

1.2 SUBMITTALS

- A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembly components.
 - 02 Show details of field fabrications, connections and details.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 2" x 2" but must be large enough to convey attributes of the proposed product.

- F. Locations and quantity of ADA compliant lockers with approved graphics.
- G. Sustainable Design (LEED) Requirements submittals: In compliance with as specified herein.
 - 01 MR Credit 4: Recycled Content (10%-20%):
 - a. Record product names, manufacturers' names, costs, percentage postconsumer content, and percentage preconsumer content.
 - b. Collect cutsheets or manufacturers' letters to document the listed products' recycled content.
 - c. Where appropriate, maintain a list of actual materials costs, excluding labor and equipment sections such as foundations, paving, site improvements, and planting.
 - d. For steel products where no recycled content information is available, assume the recycled content to be 25% postconsumer.

1.3 WARRANTY

- A. Warrant the Work specified herein against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.
 - 01 Athletic Lockers: Ten (10) years.
- B. Defects shall include, but not be limited to the following:
 - 01 Rapid deterioration of finish.
 - 02 Loose or missing parts.
 - 03 Non-functioning components and mechanisms.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of Heavy Duty Lockers and Wood Benches are based on products manufactured by Republic Storage Systems, Inc.
- B. Other acceptable locker manufacturers acceptable for use on the Project, provided the proposed products meet or exceed all specified requirements.
 - 01 Lyon
 - 02 List Industries, Inc.
 - 03 Medart, Inc.
 - 04 Penco Products
- C. Design of wood benches is based on products manufactured by Robinson Steel Company.
- D. Other acceptable bench manufacturers acceptable for use on the Project, provided the proposed products meet or exceed all specified requirements.
 - 01 Global Industries
 - 02 Hollman
 - 03 Penco Products

2.2 HEAVY DUTY LOCKERS

A. Materials:

- 01 Steel: All sheet steel used in fabrication shall be prime grade free from scale and imperfections and capable of taking a heavy coat of high gloss baked enamel.
- 02 Fasteners: Cadmium, zinc or nickel plated steel; bolt heads, slotless type; self-locking nuts or lock washers.
- 03 Hardware:
 - a. Equipment: Hooks and hang rods of cadmium plated or zinc plated steel or cast aluminum.
 - b. Handle: Stainless Steel recessed handle.
 - c. Number Plates: To be polished aluminum with not less than 3/8 inch high etched numbers attached to door with two (2) aluminum rivets.

B. Fabrication:

- 01 General: All lockers shall be factory-assembled, of all MIG welded construction, in multiple column units to meet job conditions. Assembly of locker bodies by means of bolts, screws, or rivets will not be permitted. Welding of knockdown locker construction is not acceptable. Grind exposed welds and metal edges flush and make safe to touch.
- 02 Finishing: All locker parts to be cleaned and coated after fabrication with a seven (7) stage zinc/iron phosphate solution to inhibit corrosion, followed by a coat of high-grade enamel electrostatically sprayed and baked at 325°F for a minimum of 30 minutes to provide a tough durable finish. Color shall be as selected by Architect from manufacturer's standard colors.
 - a. Two-Tone Color Combination: Shall be at no additional cost with the locker body, frame and trim chosen from one (1) standard color and the doors chosen from a second standard color.
- 03 Doors: Outer door to be fabricated from single sheet prime 14 gauge. Doors shall have ventilated louvers on the top and bottom. All body parts solid.
- 04 Frame: Fabricate of 16 gauge (minimum) channels, with integral continuous door stop / strike formed on vertical members.
- 05 Doors 15" or wider: Outer door to be fabricated from single sheet prime 14 gauge with 7/8 inch double bends at top and bottom and 3/4 inch double bends at the sides with a minimum 3 inches wide 18 gauge full height channel door stiffener MIG welded to the inside of door face at the hinge side as well as the top and bottom return bends.
- 06 Door Locker Handle: All locker doors shall have hasp to receive a padlock and meet ADA requirements.
- 07 Latch Assembly: Shall be **two-point** rigid non-moving positive latch by means of a heavy gauge (minimum 12 gauge) latch securely welded to the 14-gauge vertical frame member. The latch assembly must be made of a single piece of steel and receive a padlock. A pry resistant lug which inserts into the door shall be an integral part of the 12 gauge latch. Rubber bumpers shall be securely attached to the door strike. If built-in locks are to be used on openings 30 inches high or higher, a 14 gauge horizontal support channel (HAS) shall be bolted to the side panel and the back side of the latch as reinforcement.
- 08 Door Hinges: Shall be continuous hinges – no exceptions.
- 09 Body: Fabricate back and sides of 18 gauge (minimum) sheet steel, with double flanged connections extending full height, form top, bottom and

- intermediate tier dividers of 16 gauge (minimum) sheet steel with single return bends at all sides. Bolt to front horizontal frame members in addition to side panels. Form hat shelves at single tier lockers of 16 gauge (minimum) sheet steel with single bends at sides and back and a double bend at front.
- 10 Equipment: Furnish each locker with the following items, unless otherwise shown.
- a. Double or triple tier lockers: One (1) double prong ceiling hook and not less than three (3) single prong wall hooks. (Two (2) single prong wall hooks only at nine (9) inches wide).
- 11 Finished End Panels (if applicable): Shall be "Boxed" type formed from 16 gauge cold rolled steel with 1/2 inch O.D. double bends on sides and a single bend at top and bottom with no exposed holes or bolts. End panels must be formed with slope at top to cover the ends of the continuous slop tops. Finish to match lockers. Provide at all exposed ends.
- 12 Continuous Slope Tops (if required): Not less than 18 gauge sheet steel, approximately 18 degrees pitch, in lengths as long as practical but not less than four (4) lockers. To be installed in addition to the locker flat top with end closures for support. Finish to match lockers.
- 13 Fillers: Provide where indicated, of not less than 16 gauge sheet steel, factory fabricated and finished to match lockers.
- 14 Approved Product: "Republic Heavy Duty "Quiet" Steel Two Point Latch" knock-down corridor lockers in types, sizes, and locations as shown on drawings.
- 15 Provide required accessible quantity of each type of locker (minimum 5 percent – rounded up in each cluster) to comply with ADA and TAS requirements. Include intermediate bottom shelf and ADA / TAS approved locking mechanism
- Doors: Outer door to be fabricated from single sheet prime 14 gauge. Doors shall have ventilated louvers on the top and bottom. All body parts solid.
- 16 Frame: Fabricate of 16 gauge (minimum) channels, with integral continuous door stop / strike formed on vertical members.
- 17 Doors 15" or wider: Outer door to be fabricated from single sheet prime 14 gauge with 7/8 inch double bends at top and bottom and 3/4 inch double bends at the sides with a minimum 3 inches wide 18 gauge full height channel door stiffener MIG welded to the inside of door face at the hinge side as well as the top and bottom return bends.
- 18 Door Locker Handle: All locker doors shall have hasp to receive a padlock and meet ADA requirements.
- 19 Latch Assembly: Shall be **two-point** rigid non-moving positive latch by means of a heavy gauge (minimum 12 gauge) latch securely welded to the 14-gauge vertical frame member. The latch assembly must be made of a single piece of steel and receive a padlock. A pry resistant lug which inserts into the door shall be an integral part of the 12 gauge latch. Rubber bumpers shall be securely attached to the door strike. If built-in locks are to be used on openings 30 inches high or higher, a 14 gauge horizontal support channel (HAS) shall be bolted to the side panel and the back side of the latch as reinforcement.
- 20 Door Hinges: Shall be continuous hinges – no exceptions.
- 21 Body: Fabricate back and sides of 18 gauge (minimum) sheet steel, with double flanged connections extending full height, form top, bottom and intermediate tier dividers of 16 gauge (minimum) sheet steel with single return bends at all sides. Bolt to front horizontal frame members in addition to side panels. Form hat shelves at single tier lockers of 16 gauge (minimum) sheet steel with single bends at sides and back and a

- double bend at front.
- 22 Equipment: Furnish each locker with the following items, unless otherwise shown.
 - a. Double or triple tier lockers: One (1) double prong ceiling hook and not less than three (3) single prong wall hooks. (Two (2) single prong wall hooks only at nine (9) inches wide).
 - 23 Finished End Panels (if applicable): Shall be "Boxed" type formed from 16 gauge cold rolled steel with 1/2 inch O.D. double bends on sides and a single bend at top and bottom with no exposed holes or bolts. End panels must be formed with slope at top to cover the ends of the continuous slop tops. Finish to match lockers. Provide at all exposed ends.
 - 24 Continuous Slope Tops (if required): Not less than 18 gauge sheet steel, approximately 18 degrees pitch, in lengths as long as practical but not less than four (4) lockers. To be installed in addition to the locker flat top with end closures for support. Finish to match lockers.
 - 25 Fillers: Provide where indicated, of not less than 16 gauge sheet steel, factory fabricated and finished to match lockers.
 - 26 Approved Product: "Republic Heavy Duty "Quiet" Steel Two Point Latch" knock-down corridor lockers in types, sizes, and locations as shown on drawings.
Provide required accessible quantity of each type of locker (minimum 5 percent – rounded up in each cluster) to comply with ADA and TAS requirements. Include intermediate bottom shelf and ADA / TAS approved locking mechanism.
- C. Sizes and locker types (Refer to Drawings for locations and quantities):
- 01 Locker Type A – Corridor / Student:
 - a. 12" x 12" x 36".
 - b. Double tier 72" overall ht. (excluding base and cap).
 - 02 Locker Type F – Custodial Staff:
 - a. 12" x 12" x 36".
 - b. Double tier 72" overall ht. (excluding base and cap).

2.3 LOCKER BASES

- A. All lockers shall be installed on a continuous, cast-in-place concrete base in configuration as indicated on the Drawings. If not indicated, base shall be 4 inches tall by depth required by locker manufacturer for proper installation.
- B. Concrete bases shall include continuous, embedded treated 2x lumber for anchoring lockers.
- C. Coordinate with Contractor / other trades as required for proper installation of locker bases.

2.4 ADA BENCHES

- A. Materials:
 - 01 Benches: Provide manufacturer's standard laminated hardwood bench tops and backs.
 - 02 Size: 20" deep x 42" long in accordance with ADA / TAS requirements.
 - 03 Bench Height: 17-1/2".
 - 04 Fixed Benches: Provide manufacturer's heavy-duty steel pedestal (with flanges) supports not more for securing the bench, and the bench to the floor. Floor anchors shall be minimum 3/8" x 4" stainless steel anchors.

- 05 Anchorage: Furnish all anchorages required for a secure installation.
- 06 Finish: Apply manufacturer's standard clear coating to bench tops and baked enamel finish to metal items in manufacturer's standard color as selected by the Architect.

2.5 CTE LAB BENCHES

- A. Materials:
 - 01 Benches: Shall be concrete as per details and indicated on the Drawings.
 - 02 Pedestals: Provide manufacturer's heavy-duty cast iron pedestal supports not more than 6 feet-0 inches O.C. for fastening to the floor and securing the bench to floor. Provide trapezoidal shaped pedestals at moveable benches.
 - 03 Anchorages: Furnish all anchorages required for a secure installation.
 - 04 Finish: Apply manufacturer's standard clear coating to bench tops and baked enamel finish to painted items in manufacturer's standard neutral color.

PART 3 - EXECUTION

3.1 PREPARATION / COORDINATION

- A. Coordinate with Contractor and other trades as required for proper installation of concrete bases required at lockers.

3.2 INSTALLATION

- A. Assemble lockers in accordance with the manufacturer's written instructions. Lockers shall have no sharp metal edges.
- B. Install lockers and benches plumb, level, and flush in the locations shown on the Drawings in accordance with the manufacturer's instructions.
- C. Anchor lockers to the floor and wall as recommended by the manufacturer.
- D. Install slope hoods, metal fillers, end panels and trim to close openings, and accessories using concealed fasteners. Provide flush hairline joints against adjacent surfaces.
- E. Install number plates in order as directed by the Architect.
- F. Install benches where indicated on the Drawings. Secure bench to floor to provide fixed installation.

3.3 ADJUST AND CLEAN

- A. Adjust doors and latches to operate without binding and positive latching and automatic locking.
- B. Touch up marred finishes with factory-supplied paint.

END OF SECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53

SECTION 11 31 00

RESIDENTIAL APPLIANCES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide all residential / commercial appliances indicated on the Drawings, including, but not limited to:
 - a. Refrigerators / Freezers
 - b. Ice Makers
 - c. Washers / Dryers
 - d. Microwave Ovens
- C. Related Work:
 - 01 Section 11 40 00 – Food Service Equipment
 - 02 Division 22 – Plumbing
 - 03 Division 26 – Electrical

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- D. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.

- 1 E. Shop Drawings: Submit complete Shop Drawings consisting of design,
2 fabrication and erection / installation of proposed assemblies.
3 01 Show profiles, sizes, spacing and locations of assembly components.
4 02 Show details of shop fabrications, connections and details.
5 03 Show details of field fabrications, connections and details.
6
7 F. If products are provided by an acceptable manufacturer not used in the basis-of-
8 design, provide Shop Drawings indicating revisions required to adjacent or
9 interfacing assemblies.
10
11 G. Operations and Maintenance Manuals:
12 01 Provide complete operations and maintenance manuals to the Owner.
13 02 Refer to section 01 78 23 – Operations and Maintenance Manuals
14 03 O & M manuals must be reviewed, accepted and delivered to the Owner
15 prior to Owner demonstration(s).
16
17 H. For warranties longer than one (1) year, submit a sample of the warranty
18 proposed to be furnished.
19

20 **PART 2 - PRODUCTS**

21 **2.1 MANUFACTURERS**

- 22
23
24 A. Design of residential appliances is based on products manufactured by GE;
25 unless otherwise indicated in the appliance descriptions below.
26
27 B. Acceptable Manufacturers: The following manufacturers are acceptable to
28 provide residential appliance products of this Section, provide all proposed
29 products meet or exceed the specified requirements.
30 01 Electrolux
31 02 Kenmore
32 03 LG
33 04 Maytag
34 05 Uline
35 06 Whirlpool
36
37 C. Design of ice machines is based on products manufactured by Scotsman.
38
39 D. Acceptable Manufacturers: The following manufacturers are acceptable to
40 provide ice machine products of this Section, provide all proposed products meet
41 or exceed the specified requirements.
42 01 Hoshizaki
43 02 Manitowac
44 03 Subzero
45 04 U.S. Ice Machine Mfg. Co.
46 05 U-Line
47
48 E. All appliances shall meet the requirements of Americans with Disability Act (ADA)
49 and Texas Accessibility Standards (TAS).
50

51 **2.2 RESIDENTIAL APPLIANCES**

- 52
53 A. Refrigerator / Freezer (bottom):
54 01 Manufacturer: GE Refrigerator / Freezer.
55 02 Model No.: GDE225EYKFS, 24.8 CF refrigerator / freezer (on bottom)
56 with ice maker and water filtration.

- 1 03 Dimensions: 32-3/4"W x 69-7/8"H x 337-1/2"D.
- 2 04 LED lighting
- 3 05 Color: Stainless Steel (SS).
- 4
- 5 B. Under counter Refrigerator:
- 6 01 Manufacturer: Summit Shallow Depth Built in Refrigerator with Key lock.
- 7 02 ADA Compliant
- 8 03 Energy Star Certified
- 9 04 LED Lighting
- 10 05 Model No.: FF195ADA Compact Refrigerator.
- 11 06 Suitable for mounting below a 1-1/4" thick, 34" high countertop.
- 12 07 Dimensions: 32.5"H x 19"W x 17.25"D
- 13 08 Color: Stainless Steel
- 14
- 15 C. Microwave:
- 16 01 Manufacturer: GE Countertop Convection / Microwave.
- 17 02 Model No.: PEB 9159SJSS- Profile Series, 1.5 CF Countertop
- 18 Convection / Microwave Oven.
- 19 03 Dimensions: 21-3/4"W x 13"H x 20"D
- 20 04 Color: Stainless Steel (SS).
- 21 05 Refer to Drawings for built-in conditions.
- 22
- 23 D. Washer: (*front load*)
- 24 01 Manufacturer: GE Front Load Washer.
- 25 02 Washer Model No.: GFW550SSNWW 4.8 DOE CF Capacity RightHeight
- 26 Design Front Load Washer.
- 27 03 Dimensions: 28"W x 39-3/4"H x 32"D.
- 28 04 Energy Star Qualified
- 29 05 ADA Compliant.
- 30 06 Color: White.
- 31
- 32 E. Dryer: (*mate to front load washer*)
- 33 01 Manufacturer: GE Front Load Electric Dryer.
- 34 02 Dryer Model No.: GFD55ESSNWW 7.8 CF Capacity RightHeight Design
- 35 Front Load Electric Dryer.
- 36 03 Dimensions: 28"W x 39-3/4"H x 32"D.
- 37 04 Energy Star Qualified
- 38 05 ADA Compliant.
- 39 06 Color: White.
- 40

2.3 ICE MACHINE

- 41
- 42
- 43 A. Free-Standing Ice Machine: Manitowoc Model RNF-0320A Nugget ice machine on
- 44 D320 Ice Bin with 6" adjustable legs. Connect with utilities as required.
- 45 01 Located at teacher and Admin Lounges
- 46 02 Self-contained air-cooled condenser, ice maker and storage bin.
- 47 03 Construction:
- 48 a. Stainless steel exterior with the fit and finish of an appliance
- 49 b. Rugged, corrosion-free base
- 50 c. R-404A CFC-free refrigerant
- 51 04 Capacity: 308 LB (24 hours)
- 52 05 Bin Capacity: 263 LB minimum
- 53 06 Electrical: 115 / 60 / 1
- 54 07 Dimensions: 76 inches high by 22 inches wide by 34 inches deep
- 55 08 With inline Filter
- 56 09 Coordinate with Electrical and Plumbing. Coordinate with floor Drain

- 10 Specifications:
- a. BTU Per Hour: 3,077 (average) 4062 (peak)
 - b. Compressor: Nominal rating of ½ HP
- 11 Operating Limits:
- a. Ambient Temperature Range: 50°F to 110°F
 - b. Water Temperature Range: 37°F to 90°F
 - c. Water Pressure Ice Maker:
 - d. Water In: minimum 14 psi, maximum 80 psi
- 12 Warranty:
- a. Evaporator: Five (5) years for parts and labor
 - b. Compressor: Five (5) years for parts and three (3) years for labor.
 - c. Ice machines, dispenser and Storage Bin Components: Three (3) years for parts and labor.

PART 3 - EXECUTION

3.1 COORDINATION AND PREPARATION

- A. Where appliances are shown to be built into casework and other assemblies, coordinate with other trades as required to provide proper clearances and installation of appliances.
- B. Coordinate with electrical, mechanical and plumbing trades as required for proper connection and interface with appliances.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's printed instructions.
- B. Adjust for proper operation.

END OF SECTION

SECTION 11 40 00
FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK

- A. Project Name and Location: Tomball High School
Tomball, Texas
- B. Approval of Working Surface: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. The beginning of work by any contractor shall constitute acceptance of the previous work.
- C. Field Verification of All Dimensions: Before ordering any materials or doing any work, field verify all measurements of the building and be responsible for their accuracy. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect or Foodservice Design Professionals (FDP) for instructions before proceeding.
- D. Cutting and Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true, and of the proper size in their work, as may be necessary for the proper installation of their and other contractors' work. After such work has been installed, the contractor shall carefully fit around, close, repair, patch, and point up the same as directed to the satisfaction of the Architect.
- E. Cooperation: The General Contractor, all other contractors, and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity to install their work and store their material.
- F. Inspection and Tests: The architect, Owner, Foodservice Design Professionals (FDP), and their representative shall always have access to the work, whether in preparation or progress. Provide proper and safe facilities for such access and inspection.
- G. Fees, Permits, and Inspections: Secure and pay fees for all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, codes, rules, regulations, and contract requirements bearing on the work.

1.3 SCOPE OF WORK

- A. Include the Work specified, shown, or inferable as part of Food Service Equipment. Portions of this Work may be subcontracted to those qualified to do such work as necessary because of jurisdictional trade agreements and restrictions.
- B. The General Contractor is responsible for Related Work specified in other Sections: i.e., final plumbing, electrical and mechanical connections. The Kitchen Equipment Contractor (KEC) is responsible for all internal connections.

- C. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and equipment adjustment in this contract. Plans and specifications shall be considered mutually explanatory. Work required by one, but not by the other, shall be performed as though required by both. Items required by one but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings so that all equipment items shall be entirely functional for the purpose for which they were designed and intended. Provide all necessary material, tools, equipment, and labor required for the complete delivery, un-crating, erection, and installation as designated on the food service equipment plan and, in the specifications, to be made ready for final connection by the appropriate Division contractors. When there is any discrepancy between drawings and specifications, bidders should seek clarification of any discrepancies from the Architect and or Foodservice Design Professionals (FDP) before bidding.
- D. Should the drawings disagree in themselves or the specifications with the drawings (*and clarification was not sought before bidding*), the higher cost, better quality, more stringent, and greater quantity of the work or materials shall be completed without additional costs to the Owner.

1.4 OTHER DIVISIONS/CONTRACTORS RELATED WORK

A. Division 03 (Concrete) is responsible for but not limited to:

- 1. Slab depressions reinforced concrete wearing bed at prefabricated cold storage assemblies.
- 2. Concrete or masonry platforms (with a finished top and coved base at the perimeter) for the raised setting of food service equipment.
- 3. Slab depressions to receive stainless steel drain trench liner/grate assemblies (provided under this Section).

B. Division 09 (Finishes) responsible for but not limited to:

- 1. Interior finished floor with a coved base at prefabricated cold storage assemblies.

C. Division 10 (Specialties) responsible for but not limited to:

- 1. S/S Corner Guards throughout the kitchen (unless specified otherwise).
- 2. Lockers.

D. Division 22 (Plumbing) is responsible for but not limited to:

- 1. All connections shall follow local codes and national standards, except where plans and specifications exceed those codes and standards.
- 2. Empty PVC and wide-sweep bends for refrigerant piping to beverage lines, Co2 lines, and remote food service equipment refrigeration systems.

3. Rough-in and final connection of plumbing systems to food service equipment and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 22. This includes but is not limited to the installation of all faucets (water fill faucets, pre-rinse faucets, etc.), hoses, gas disconnects, and drains from the equipment point of connection to building plumbing systems.
 - a. Kitchen Equipment Contractor is responsible for providing all faucets (water fill faucets, pre-rinse faucets, etc.), drain fittings, mixing valves, control valves, water pressure regulators, vacuum breakers, and all accessories for equipment specified under 11 40 00. Division 22 is responsible for installation.
4. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type 'K' Copper.
5. If any plumbing accessories or fittings are provided loose with equipment by 11 40 00, Div. 22 is to attach to equipment and provide final connection.
6. Gas Supply Systems with all components and fittings required for a complete system.
7. Water Supply Systems with all components and fittings required for a complete system.
8. Compressed Air Systems with all components and fittings required for a complete system.
9. Piping and Drainage Systems (Sanitary and grease laden). Systems are to be cleaned before the final connection with food service equipment.
10. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.
11. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.
12. Trench Drains (Provide and Install). Trench Liners provided by 11 40 00. Flange and liners to be flush with the finished floor.
13. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe thru Grease Trap and/or Interceptor.
14. P-Traps as required (including all disposers).
15. Interconnect water thru Water Filter (Filter provided by 11 40 00 unless otherwise specified) to equipment.
16. Gas Quick Disconnect Installation (Quick Disconnect provided by 11 40 00).
17. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 11 40 00).
18. Specified couplings and piping to all equipment furnished by 11 40 00.
19. Air Compressors (Size, Provide, and Install unless otherwise specified).
20. Water Softeners (Size, Provide, and Install unless otherwise specified).
21. Pressure Boilers (Size, Provide, and Install unless otherwise specified).
22. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required. Water temperature to be at least 100 degrees and flow for at least 20 seconds.

23. Ice Bin Drain Insulation (Provide and Install).
24. Unions at disposer solenoid valves (Provide and Install).
25. Back Flow Prevention as required (Provide and Install - including all disposers). Back-Siphonage shall be installed at all fixtures and equipment where backflow and/or back-siphonage may occur and where a minimum air gap cannot be provided between the water to the fixture or equipment at its flood/level rim. When furnished with equipment, vacuum breakers shall override the above if acceptable with applicable codes. Division 22 is responsible for verifying requirements with local codes.
26. Janitor Sink with Faucet (Provide and Install).
27. Freeze Proof Hose Bibb at the exterior of the building by receiving door (Provide and Install - unless otherwise specified).
28. Reverse Osmosis Systems (Size, Provide (unless otherwise specified), Locate, and Install).
29. All piping within the counter body or under fabricated counters must be run to a connection point below the counter body by Section 11 40 00—final connection by Division 22.
30. Exhaust Hood condensate drain connections (Provide and Install).
31. Interconnection of ½" CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker.
32. Fire System Piping. The exposed piping is to be chrome plated.
33. Pipe ½" cold water to swirl inlets at disposers.
34. Water Treatment for Ice Builders (Non-Chlorinated water with a PH Level of 10 or Higher) and any drains and overflows. Piping from Ice Builders to Tumble Chillers by Div. 23.
35. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

E. Division 23 (Mechanical) responsible for but not limited to:

1. All connections shall follow local codes and national standards, except where plans and specifications exceed those codes and standards.
2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.
3. Rough-in and final connection of mechanical systems to food service equipment, cold storage assemblies, and between components (including materials and labor).
4. A mechanical contractor will test and balance rooms and exhaust hoods. **Balance report for food service Exhaust Hoods to be provided to Foodservice Design Professionals (FDP) immediately upon completion (send to Houston.Submittal@fdp.org) and must be submitted with O&M manuals.**

5. Exhaust Hoods, Condensate Hoods, Fire Suppression Systems, connections, and controls (Provide and Install – unless otherwise specified). Provide tempered air at all supply ducts.
 - a. If Exhaust/Condensate Hoods and Fire Suppression Systems are specified under Section 11 40 00, Division 23 is responsible for all Exhaust and Condensate Hood connections (Provide and Install).
6. VFD System and controllers when required by code (Provide and Install).
7. Provide and install all ventilation (direct or indirect), air conditioning, and heating systems (unless otherwise specified).
8. Coordinate Supply and Return ducts above Serving Counters. Cold air is not to blow directly on hot food counters or open-air refrigerated merchandisers.
9. Coordinate Supply and Return ducts away from equipment with top-mounted refrigeration. Air is not to blow directly on compressors.
10. Mechanical Contractor to locate temperature monitors within return ducts.
11. Circulating air above cold storage assemblies (Provide and Install).
12. Circulating air above and in air gaps at Warehouse cold storage assemblies (Provide and Install).
13. Water Chillers as required (Provide, Size, and Locate).
14. Piping from Ice Builders to Tumble Chillers (Size, Provide and Install).
15. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

F. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, cold storage assemblies, and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 26.
2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.
3. Empty EMT Conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPUs, etc. Division 26 to verify where the conduit will run for POS System (i.e., Manager's Office or IDF Room).
4. Empty EMT Conduit with pull-wire and wide-sweep bends for fire suppression systems. Interconnect the Fire Protection System to panel box shunt trips and building alarms.
5. Cold Storage Assembly Light Fixture Installation (Provided loose by Section 11 40 00).
6. Table Limit Switch Installation (Provided loose by Section 11 40 00).
7. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).

8. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).
9. Charging Stations for Forklifts, Pallet Stackers, and Pallet Jacks (Size, Provide, Locate, and Install).
10. Interconnection between Condensate Fan and Dishmachine control panel.
11. Interconnection between Exhaust Hood fans and switch.
12. Interconnection between Exhaust Hood lights and switch.
13. Door Heaters, Lights, Coils, and Heated Pressure Relief Ports pre-wired to the junction box at the top of cold storage assemblies provided by Section 11 40 00—final connection by Div. 26.
14. If any electrical accessories, fittings, and cord/plugs are provided loose with equipment by 11 40 00, Div. 26 is to attach to equipment and provide final connection.
15. Provide waterproof receptacles in wet areas.
16. All electrical connections beneath Exhaust Hoods to extend to shunt trip breakers with electrical panel box for shutdown during fire mode.
17. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.
18. All electrical lighting, power, and distribution systems.
19. Do not interconnect more than three (3) convenience outlets on one (1) breaker.
20. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.
21. Doorbell at receiving door (Provide and Install –audible throughout Kitchen, Office, and Dry Storage room).
22. Adequate lighting at receiving door.
23. Dedicated circuit for heated drain line connection in Walk-In Freezer (120/1/16.0 Amp) at each coil.
24. Provide and install (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. One (1) to be located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an 'inline' assembly), and One (1) to be located in the Cafetorium (Coordinate location with Owners). Provide all conduit and wiring required and interconnect the illuminated Push Button Panic Alarm in the Walk-In Freezer to both Strobe Beacons (**Critical**). Coordinate with Division 27.
25. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.

G. Division 27 (Communication) responsible for but not limited to:

1. Data line coordination for food service equipment.
2. Time clocks.
3. Video cameras for learning assistance in food service areas as required (Provide, Locate, and Install).

4. Provide conduit, data line, and interconnect the illuminated Push Button Panic Alarm inside the Walk-In Freezer to the Building Automation System (BAS). When activated, facility personnel are to be notified - coordinate notification requirements with the Owner (**Critical**). Coordinate with Division 26.

H. Division 28 (Electronic Safety and Security) is responsible for but not limited to:

1. Security Cameras as required (Provide, Locate, and Install).

I. General Contractor responsible for but not limited to:

1. Any wall penetration required for food service equipment utilities. Escutcheon plates or S/S sleeves are to be provided and installed as needed.
2. Bulk Freezer Ventilation Pipe (Provide and Install unless otherwise specified).
3. Core drilling for Guide Rails.
4. Refrigeration Roof Curbs / Roof Jack.
5. Interior Bollards – to be epoxy painted per local codes (Provide and Install).
6. Provide and Install ¾" Plywood blocking in the wall for mounting equipment furnished by Section 11 40 00 as required.
7. Cold Storage Assembly Depressions (to be dead level) and sand leveling bed.
8. Structural bracing for Bulk Cold Storage Assembly ceiling panels if required.
9. Menu System Video Monitors in Served (unless otherwise specified).
10. Structural bracing for Menu System Video Monitors if required.
11. Interior/Exterior refrigeration penetrations and sleeves at building penetrations.
12. DoorScope viewer (peephole) with wide viewing angle at receiving door.
13. Canopy at receiving door. Coordinate height with the height of Receiving Door (8') and the mounting height of Air Screen above the door.
14. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.
15. Washer and Dryer (Provide and Install, unless otherwise specified).
16. Dwarf wall at exposed front/ends of cafeteria serving counters with the finish as selected by the Architect.
17. Final cleaning of all equipment before demonstrations.

1.5 QUALITY ASSURANCE

- A. In addition to complying with all applicable laws, statutes, building codes, and regulations of public authorities, comply with the following:
1. National Sanitation Foundation (all equipment to bear label)
 2. National Electric Code
 3. Underwriters' Laboratories, Inc. (all applicable equipment to bear label)

4. American Gas Association Laboratories
 5. National Fire Protection Association
 6. Americans with Disabilities Act
 7. Food and Drug Administration HACCP Guidelines
 8. International Energy Conservation Code (IECC)
 9. Department of Energy
 10. Environmental Protection Agency
- B. Furnish certification of regularly manufactured equipment listing or classification by Underwriter's Laboratories, Inc. with the initial submittal.
 - C. Furnish a list of equipment and components (internal and external) that are not of domestic origin. All equipment and components (internal and external) should be of domestic origin when possible. This information should be provided with the initial submittal.
 - D. Projects outside the continental United States shall adhere to all local authorities having jurisdiction over that project.

1.6 SUBSTITUTIONS

- A. **Equipment items or components specified are intended to be the Basis of the Bid. All other brands, including any additional names, which may be listed as "Alternates" or "Approved Equal," must conform with the general and item specifications, warranties, size/dimensions, quality, accessories, function, voltage, horsepower, etc. of the first-named brand and be subject to Paragraph C-03 of this Article.**
- B. Proposed Substitutions:
 1. Submitted at least 14 calendar days before Bid Date.
 2. Submit proposed substitutions with catalog data and manufacturer's shop details indicating all modifications required to conform with the specified brand.
 3. List of deviations must include equipment name, model number, accessories, and features with deviation(s) noted for specified and proposed alternate equipment. Equipment without listed deviation(s) will be considered furnished as specified.
- C. Substitutions with prior approval:
 1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.
 2. Owner reserves the right to accept or reject any or all substitution proposals before execution of the Contract.
 3. Provide all design/engineering services required to adjust in space, systems, utilities, etc., and pay all additional costs of utilities, construction, or professional services that may be incurred due to the acceptance of any substitution.
- D. All appliances within a common group or category (e.g., refrigerators, kettles, ovens, etc.): same manufacturer.

1.7 INTERPRETATION OF DOCUMENTS

- A. During Bidding: Bidder's, supplier's, or vendor's questions and comments about Construction Document's clarity or intent will be addressed by addendum.
- B. After Award:
 - 1. Clarification Bulletin will confirm Construction Document requirements.
 - 2. Request for Information submitted by Contractor shall contain Contractor's proposed resolution.

1.8 WARRANTY

- A. Provide a written warranty for parts and labor for one year from the date of Substantial Completion, including an extended four-year replacement warranty on compressor bodies.
- B. Components of equipment subject to replacement before one year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.
- C. Refrigeration Systems/Equipment: One-year free service available within twenty-four hours of notification.
- D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number, and name of the person to contact. The service agencies selected shall be factory-authorized for the equipment assigned whenever possible.
- E. Provide the following for refrigeration systems/equipment unless specified otherwise:
 - 1. One (1) year of free refrigeration system service is available within twenty-four hours of notification.
 - 2. Provide five (5) year manufacturer's registered written replacement warranty certificate covering compressor bodies. Warranty to cover labor costs for the first year.
 - 3. Provide ten (10) years of the manufacturer's registered written replacement/repair warranty certificate covering cold storage assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.
 - 4. Provide one (1) year parts and labor warranty for all parts of the refrigeration system(s) and cold storage cooler(s) and freezer(s) not otherwise covered herein.
- F. All above-stated warranty periods are from the date of Substantial Completion. All replacement parts due to a warranty call should be the same quality as the original. Replacement parts should be of a domestic origin where possible.

1.9 SUBMITTAL DATA

- A. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.
- B. Submittal Requirements:
 - 1. Kitchen Equipment Contractor to furnish all submittals via PDF, drawings to be scaled per General Specifications and provided in Three (3) submittal packages.

2. Foodservice Design Professionals requires the below-listed business days for each package submitted. Packages are to be submitted within 14 days between each issued package. Each package should contain individual submittal sets.
 - a. Package One to include (2) Individual sets: 10 Business Days for Review
 - i. Equipment rough-in
 - ii. Equipment Brochure
 - b. Package Two to include (3) Individual sets: 10 Business Days for Review
 - i. Exhaust Hoods
 - ii. Cold Storage Assemblies
 - iii. Refrigeration
 - c. Package Three to include (4) Individual sets: 15 Business Days for Review
 - i. Custom Fabrication
 - ii. Serving Counters
 - iii. Merchandising Equipment
 - iv. Miscellaneous Submittals
- C. Submittals to be identified with the below-listed file name structure:
 1. 11 40 00-1 EQUIPMENT BROCHURE
 2. 11 40 00-2 EQUIPMENT ROUGH-IN PLANS
 3. 11 40 00-3 CUSTOM FABRICATION
 4. 11 40 00-4 SERVING COUNTER
 5. 11 40 00-5 EXHAUST HOODS
 6. 11 40 00-6 COLD STORAGE ASSEMBLY
 7. 11 40 00-7 REFRIGERATION
 8. 11 40 00-8 BEVERAGE MERCHANDISER
- D. Package One (1) requires both submittals: Brochure and Rough-in plans. **If not sent together, the submittal will be rejected.**
- E. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.
- F. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.
- G. If discrepancies, missing information, or incorrect information occur within the documents, Kitchen Equipment Contractor is to seek clarification or note the need for further direction on submittals. The Kitchen Equipment Contractor is to bid the higher of the discrepancies. *Refer to Section 1.3 SCOPE OF WORK: Subsection D.*

- H. Brochure Format (for regularly manufactured equipment and components):
1. Front and rear protective cover with labeled project name.
 2. Brochure index: Indicate Functional Area/Room number, item number, quantity, description, and manufacturer.
 3. A separate flysheet for each component or item of equipment, indicating item number, name, quantity, manufacturer, optional equipment, modifications, special instructions, and utility requirements. Any equipment or assembly containing more than one buyout sub-assembly or component shall have the second item listed in parenthesis beside the primary item name—for example, Serving Counter (hot food well).
 4. Catalog specification sheet with all options notated on the specification sheet and manufacturer's drawing.
- I. Shop Drawings (Rough-In Drawings):
1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced). Submittal drawings are to be provided by Kitchen Equipment Contractor and not copied or reproduced from Contract Documents. Any reproduced submittal drawings will be rejected.
 2. 1/4" scale drawing of fixed/movable food service equipment and prefabricated Cold Storage Assemblies with itemized schedules.
 3. Special Conditions Drawings, sizing, and locating the following conditions:
 - a. Slab depressions, cores, sleeves, or block-outs (cold storage assemblies, drain trenches, piping, etc.).
 - b. Concrete or masonry platforms.
 - c. Pipe sleeves or roof jacks.
 - d. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.
 - e. Blocking grounds or anchor plates required in walls for equipment support/attachment.
 - f. Above-ceiling hanger assemblies for support of exhaust hoods, ceiling-mounted pot racks, etc.
 - g. Access panels in walls or ceiling for service of equipment.
 - h. Ceiling pockets or recesses for unusually high equipment.
 - i. In-wall carriers for wall-hung or cantilevered equipment.
 4. Electrical Rough-In Drawing
 5. Plumbing and Mechanical Rough-In Drawing
 6. Required information:
 - a. All fixed and portable food service equipment shown on Contract Drawings.

- b. All prefabricated Cold Storage Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.
 - c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices, not in this Section.
 - d. All Rough-In Drawings: Fully dimensioned from engineering benchmark (column lines, when provided) and finished-room surface to the point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical, and plumbing services.
 - e. Connection number/tag system and symbols: Identical to Contract Drawings.
- J. Shop Drawings (Manufacturer's and Fabricator's):
 - 1. Sheet Size: Identical to Contract Drawings, drawn or plotted at a 1/4" scale for plan view, 1/2" for elevations, and 1 1/2" for sections and construction details.
 - 2. Included information: The item number, name, and quantity.
 - 3. Construction details, sections, and elevations to reflect the requirements of the Specifications and Drawings.
 - 4. Indicate adjacent walls, columns, and equipment.
 - 5. Indicate plumbing and electrical schematic drawings for equipment such as conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems, and fabricated fixtures with a single electrical or plumbing connection.
 - 6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment, or replacement of all moving parts.
- K. All equipment and engineering rough-in plans sheet numbers are to match the contract documents. All equipment item numbers and engineer item numbers located on the schedules are to match the contract documents. All engineering requirements must be updated to accommodate the provided equipment and match the contract documents. The Kitchen Contractor coordinates any MEP revisions to accommodate the supplied and proposed equipment. The Kitchen Equipment Contractor is responsible for any costs associated with equipment substitution.
- L. Foodservice Design Professionals (FDP) drawings and schedules are not to be copied in any way. Any replicated drawings of Foodservice Design Professionals (FDP) will be rejected.

1.10 SERVICE MANUAL

- A. Three copies bound in 1 1/2" hardback, three-ring binders (as many volumes as required by the scope of the project) with the same data as the brochure after installation (Refer to "Submittal Data"). Provide separate service manuals for each independent area within the project scope (Main Kitchen, Culinary, Concession, etc.).
- B. Each Volume: Section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).
- C. Catalog specification sheet and/or manufacturer's shop drawings.

- D. Each Volume: Index of items, manufacturer's operating/maintenance information, replacement parts data, list of all product warranties, and price lists. Provide the name, title, and address of personnel at each respective manufacturer and service personnel to be contacted for spare/replacement parts and service after the warranty period.
- E. To the extent possible, provide two copies of the manufacturer's video instructional cassettes for operating, maintenance, and equipment service.
- F. Internally subdivide binder contents with permanent page dividers, logically organized by equipment item number or manufacturer name, with tab titling printed under reinforced, laminated plastic tabs.
- G. Electronically submitted manuals must follow the formatting requirements listed above.
- H. **Service Manual to be provided to the owner before kitchen equipment demonstration.**

1.11 VERIFICATION AND COORDINATION OF PROJECT / DATA

- A. Utilities Rough-in Drawings and field verifications are to be completed within four weeks after receipt of notice-to-proceed. Review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors.
 - 1. KEC to provide on-site field verification of all underground utilities before pouring concrete for capacity and location and coordinate with General Contractor. Submit a review to Architect and General Contractor. If rough-ins need to be relocated, KEC will compensate other trades for the required relocation.
 - 2. KEC to provide on-site field verification of all other utility connections and locations and coordinate with General Contractor. Submit a review to Architect and General Contractor.
- B. On-Site Inspection Reports
 - 1. Before concrete pour: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.
 - 2. Before delivery of equipment: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.



On - Site Inspection Report
Prior to Concrete Pour

Inspection Date _____ Project Name _____
Project Location _____

Inspector's Name _____ Company _____
Inspector's Contact Number _____ Email _____

Architectural Firm _____ Contact _____
Architect's Contact Number _____ Email _____

General Contractor _____ PM _____
G.C. Contact Number _____ Email _____

Foodservice Consultant Foodservice Design Professionals, LLC PM _____
Contact Number 281.350.2323 Email _____

An on-site Inspection to verify the location of UNDERGROUND utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties, if any, were encountered?

Inspector's Initials _____

**This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at any of the inspections.**

**EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT,
GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.**



On - Site Inspection Report
Prior to Delivery of Equipment

Inspection Date _____ Project Name _____
Project Location _____

Inspector's Name _____ Company _____
Inspector's Contact Number _____ Email _____

Architectural Firm _____ Contact _____
Architect's Contact Number _____ Email _____

General Contractor _____ PM _____
G.C. Contact Number _____ Email _____

Foodservice Consultant Foodservice Design Professionals, LLC PM _____
Contact Number 281.350.2323 Email _____

An on-site Inspection to verify the location of INSTALLED utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties, if any, were encountered?

Inspector's Initials _____

**This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at any of the inspections.**

**EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT,
GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.**

- C. Review critical systems/components for application, performance, and capacity and submit calculation worksheets with the initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:
1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes, and locations.
 2. Refrigeration Systems (compressor, condenser, and evaporator) capacities/sizes, quantities, and refrigerant piping distances/sizes.
 3. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler, fuel interlocks, piping/distance limitations).
 4. Locations of Vacuum Breakers.
 5. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.
 6. Gas and water line sizes and manifold configurations.
 7. Diameter and length of flexible connector lines for fixed/movable gas appliances.
 8. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).
 9. ADA compliance of workstations, service positions, passageways, etc.
- D. Ceiling mounted appliances/fixtures: Verify and coordinate dimensions/location of support framing/hangers with the General Contractor—all material and installation below 12'-0" AFF: Section 11 40 00.
- E. Dimension Responsibility: Obtain actual or guaranteed measurements for the proper equipment fit. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment and notify the Architect of all conflicts or deviations from the dimensions shown.
- F. Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for their correctness. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.
- G. Scheduling to Fit Openings: Should it become necessary to schedule the construction of walls or partitions before delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.
- H. Refrigerated and Dry Storage Areas: Verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of the variance between the Contract Documents and actual conditions.

- I. Color/Pattern Selections: Submit selection samples of solid polymer products, plastic laminate, paint or stain finishes, and vinyl-coated surface material of equipment as selected by the Owner.
- J. Movable Equipment Interface: Rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at the time initial of shop drawing submittal. Indicate conflicts and proposed adjustments.
- K. Relocation of Work: Relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.
- L. **Kitchen Equipment Contractor must provide FDP with the food service equipment lump sum pricing (including material and labor) after the contract has been executed and before submittals are provided to FDP. This information is critical to FDP for accounting/billing purposes.**

1.12 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

- A. Obtain and coordinate utility requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and rough-in drawings/provisions.
- B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.13 WORK INSTALLED BUT FURNISHED BY OTHERS

- A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with the Owner at least ninety (90) days before equipment requirement.
- B. Obtain and coordinate utility requirements of OF/CI equipment with the building utilities and rough-in drawings/provisions.
- C. Receive at the job site and fully incorporate into installation procedures as if furnished under this Section.

PART 2 - PRODUCTS

2.1 FABRICATED FIXTURES MATERIAL / COMPONENTS

- A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.
 - 1. Stainless steel joints and seams: Heli-arc welded, free of pits and flaws, ground smooth, and polished to a No. 4 finish.
 - 2. The "grain" direction of horizontal stainless-steel surfaces: Longitudinal, including the splash back. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.
- B. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.
 - 1. Galvanized iron joints and seams: Arc-welded, free of pits, flaws, and ground smooth.
 - 2. Galvanized sheets or shapes: Washed with mineral spirits and painted with Rust-Oleum gray semi-gloss enamel.

- C. Sound Deadening: Schnee Butyl Sealant ½" wide rope positioned continuously between all frame members or contact material and underside of stainless-steel surface (sinks, tabletops, food wells, over shelves, and undershelves). Tighten stud bolts for maximum compression of sealant and trim excess.
- D. Plastic Laminates: Color/pattern selected by Architect, in 1/16" thickness for flat surfaces; 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be NSF-approved (Standard No. 35).
- E. Solid Polymer products: Color/pattern/material selected by Architect in thickness as specified. Solid Polymers and adhesives must be N.S.F. approved (Standard No. 51).
- F. Casters:
 - 1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Verti-Lock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.
- G. Cutting Boards: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated.
- H. Identification Plates, Labels, Tags:
 - 1. Prohibited Information: Names of suppliers, fabricators, and contractors.
 - 2. NSF Labels: Required on all pieces of equipment.
 - 3. Required Information: Function or purpose of controls such as display light switches, food warmer controls, etc.
 - 4. Plate Construction: Engraved phenolic plastic, secured to equipment with epoxy cement or stainless-steel screws. Furnish samples.

2.2 PLUMBING / MECHANICAL REQUIREMENTS

- A. Plumbing Fittings and Components: Furnished under this Section as follows:

Note: Fitting and components described in Items 1, 2, 3, 4, and 5 are furnished loose by 11 40 00 for final installation and connection by Division 22.

- 1. Control valves and appliance pressure regulators for water, gas, steam, and vacuum breakers: wherever required on food service equipment (chrome-plated where exposed).
- 2. Faucets and drains with and without connected overflows (unless otherwise indicated) for all sinks.
- 3. Specialty food service water-fill faucets, hose bibbs, or hose assemblies indicated in drawings/specifications.
- 4. Wade Model No. W-10 Shock-Stop shock absorbers for all food service equipment with quick-opening or solenoid-operated water valves.
- 5. T&S HW-6 Series Water Quick Disconnect hose, diameter per water connection size requirements, with safety fitting, w/coiled restraining device, full port ball valve, antimicrobial coating, lifetime warranty.

6. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food-holding components of serving counters (e.g., cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: All drains to be type 'K' Copper – Paint with aluminum paint where exposed. **Div. 22 to ensure a minimum air gap of 1" and not less than twice the effective opening of the indirect waste pipe, per code. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.**
7. Piping brackets and supports beneath fabricated equipment.
8. Closed Base Bodies: Removable 18-gauge stainless steel closure panel at plumbing penetrations under the top.
9. Control valves on Open Base fixtures: Mounted on a 14-gauge stainless steel gusset-shaped panel with h 3½" setback from the countertop edge/rim to the face of the control handle.
10. Fill hose/faucet at support pedestals or Closed Base Body: Installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger-bracket for the hose.
11. Provide filtration option as shown on contract documents (a, b, c, or combination thereof):
 - a. In-line Water Filter System:
 - i. Everpure System filters for coffee/tea brewers, icemakers, water chillers, convection steamers, and beverage systems. They should be sized per the manufacturer's recommendation.
 - b. Remote Central Water Filter System.
 - c. Remote and/or In-line Reverse Osmosis system.
- B. Gas-Heated Equipment Fittings and Components: Furnished under this Section as follows:
 1. Fixed Equipment: T&S Manufacturer Safe-T-Link "HG-4-SK" Series gas appliance connector: Coated Hose w/NPT Male Ends, Swivel Links, 2-Piece Quick Disconnect, 90° Elbow & Installation Kit. Diameter per fuel volume/connection size requirements. Gas valve diameter size per fuel volume/connection size requirements.
 - a. Restraining device: Heavy duty steel cable, fastened to equipment and walls, 3" to 6" shorter than equipment connector length.
- C. Final Plumbing Connections Provisions:
 1. Fabricated equipment containing components, fittings, and devices indicated on food service connection drawings to be connected to the building systems: each component, fitting, or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.
 2. Field-assembled equipment (e.g., prefabricated cold storage assemblies, exhaust hoods, ware wash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

3. All plumbing final connection points of equipment shall be tagged, indicating the following:
 - a. Item number
 - b. Name of devices or components
 - c. Type of utility (water, gas, steam, drain, chilled water)
- D. Ducts and Vents:
 1. Exhaust hoods furred-in to ceiling: 2" high duct collar for final connection to the duct system.
 2. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18-gauge stainless steel seamless duct risers to 6" above the finished ceiling for final connection. The duct: trimmed at the ceiling with a 16-gauge stainless steel angle flange with all corners welded.
- E. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Sub Sections E. Plumbing and F. Mechanical for additional information.

2.3 FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS

- A. Install complete with all refrigerants, oil, dials, dehydrators, gauges, and controls required for the system's proper operation.
- B. Self-contained or factory-installed compressors: Check and adjust to the proper operating temperature prescribed by FDA/HACCP.

2.4 PLUMBING TRIM

- A. Faucets: Furnished for all sinks or equipment requiring open water supply.
- B. Fill Faucets: Furnished for appliances requiring open water supply.
- C. Drain Fittings: Furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. The solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS

- A. All electrical systems, components, and accessories within the work of this Section: Certified to be in accordance with NEC 70.
- B. Electrical Fittings and Components: Furnished under this Section as follows. Coordinate food service equipment loads, voltage, and phase with the building system and confirm any existing or OF/OI equipment requirements.
- C. Cord and Caps:
 1. Coordinate all food service equipment cord/caps with related receptacles.
 2. All 120, 120/208, and 208 volts "plug-in" equipment shall have Type SO or SJO cord and plug with ground wire fastened to the frame/body of the item.

3. Cord lengths for fixed equipment: Adjusted to eliminate loose-hanging excess.
4. All non-fixed plug-in "buy-out" equipment: Hubbell configuration and ratings as required.
5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8'-0" cord length with cord-hanger strap secured to the rear of equipment or mobile stand.

D. Switches and Controls:

1. Each motor-driven appliance or electrically heated unit: Equipped with a control switch or starter per Underwriters' Laboratories, Inc., with low-voltage and overload protection.
2. Disposer controls recess-mounted in the wall: External fittings and accessories removed from the enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 4'-0" AFF to the bottom of the enclosure.
3. Disposer controls recess-mounted in counter-splash risers: External fittings and accessories removed from NEMA 4 enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 3'-0" AFF to the bottom of the enclosure. Provide the panel with a 60" long Seal-Tite electrical conduit from the bottom of the control panel for final field connections under Division 26.
4. Equipment that is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.
5. All remote manual starters, disconnect switches, magnetic contactors or starters, and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.

E. Heating Elements:

1. Electrically heated equipment: Thermostatic controls.
2. Water heating equipment: Equipped with positive low water shut-off.

F. Receptacles and Switches:

1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12" x 8½" x 3" deep recessed mounting panel sloped at a 60° angle and turned up to the top of the opening.
2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6" from the bottom of utility or compressor compartments.
3. Receptacles mounted on Open Base fixtures: Installed on a 12" x 10½" x 4½" deep 14-gauge stainless steel panel with returned ends and sloping recess—secure panel to the underframe of fixture top.
4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on the underside of the lower shelf. Vertical runs of wiring: Made in rigid conduit or within the tubular leg.

5. Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.
6. Switches installed in/on-fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and a junction box installed within 6" from the bottom of the utility or compressor compartment. All refrigeration system switches: Installed within the compressor compartment near the door opening.
7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to the load center with balanced phase loading. Load center: Ready for final connection by Division 26 and flush-mounted within the utility compartment rear panel, set back 8" from the access door. All breaker/device information will be typewritten on the circuit schedule in the load center door (number corresponding breaker/device) with an enclosed schematic wiring diagram of fixture components.
8. All receptacles are to be pre-wired to the cord and plug assembly and routed through the over-shelf post at all island equipment locations unless specified otherwise.

G. Light Fixtures:

1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).
2. LED Display Light: Install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.
3. Heat Lamps: Installed to the underside of serving shelf assemblies. When multiple 24" heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remotely from lamps.
4. **Cold Storage LED Light Fixtures: Furnished by Section 11 40 00, final installation by Div. 26. All electrical wiring and conduit, provided by Div. 26, electrically connected through the Vapor Proof light fixture base connection, located on the interior door header—all Conduit to be EMT Watertight. Door frame wiring stubs out the top of panels 8" in flexible conduit for final connection by the electrical contractor. All horizontal conduits: below ceiling panels. All lighting fixtures will be wired from inside the assembly—no penetrations through the ceiling panels. Seal-sleeved penetrations are airtight at both sides of the panel. KEC is responsible for verifying that trade contractors seal all penetrations.**

H. Final Electrical Connection Provisions:

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: Direct connected, with each component, fitting, or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.
2. Fabricated equipment containing electrically operated components and devices indicated: Circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.
3. Field-assembled equipment (e.g., prefabricated cold storage assemblies, exhaust hoods, ware wash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawings by Division 26.

4. Pre-wire the following groups of cold storage assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).
 - a. Light fixtures and switches; heated pressure-relief ports.
 - b. Door/jamb heaters.
 - c. Evaporator fans, defrost elements and drain line heaters.
5. All electrical final connection points of equipment shall be tagged, indicating the following:
 - a. Item number.
 - b. Name of devices on the circuit.
 - c. Total electrical load.
 - d. Voltage and phase.
- I. Lamps: in all food service equipment containing light fixtures. Refrigerator or heated cabinets: All exposed LED lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.
- J. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection F. Division 26 (Electrical) for additional information.

2.6 CUSTOM – FABRICATED / ASSEMBLED UNITS

- A. Mechanical or electrical operating components or products integrated into a fabricated fixture: Ventilation and service access required or recommended by the manufacturer. The service access panel(s) size and placement permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 COUNTER / TABLETOPS

- A. 14-gauge stainless steel; all free edges turned down 2" with $\frac{3}{4}$ " tight hem at the bottom—free corners: rounded on $\frac{3}{4}$ " radius.
- B. Marine edges: Turned up $\frac{1}{2}$ " on 45° angle and turned down 2" with $\frac{3}{4}$ " tight hem at the bottom.
- C. Cafeteria serving countertops at hot food stations: Full-length x 3 $\frac{1}{2}$ " x $\frac{1}{2}$ " high raised rail at (customer's) front side with 45° integral turndown to counter surface.
- D. Tops abutting high fixtures or walls: Cove up specified height and slope back 1 $\frac{1}{2}$ " at the top on 45° angle; 2 $\frac{1}{2}$ " slope where piping occurs. Turn down 1" at the rear of the splash and tight ends to the bottom of the top turndown. Secure splash turndown to the wall with a 4" long 14-gauge stainless steel "Z" clip anchored to the wall, 36" OC.
- E. Freestanding tables and all serving counter splash-risers: Turned back at a 90° angle with 1" turndown at the rear.

- F. Brace tops with rigid-welded 1½" x 1½" x 1/8" galvanized steel angle frame at the perimeter with cross bracing 2'-0" OC maximum. Provide 4" x 4" x 12-gauge stainless steel triangular pads where leg gusset welds to frame. Paint the entire frame with Rust-Oleum gray semi-gloss enamel. Angle frames: Secured to the underside of top surfaces with ¼" studs welded 9" OC maximum with chrome-plated washer, lock washer, and cap nut. Studs: Such length that cap nuts can be made up tight, bringing the top down snugly on the angle frame eliminating all vibrations or "oil-canning."
- G. Tops: 1½" overhang at free sides of underframe or Closed Base Body.
- H. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly or integrally welded stainless-steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground, and polished to match the top. When conditions permit, provide a 1" x 1½" rectangular backsplash opening for service utilities instead of piercing the horizontal surface. Install stainless steel split tubing at the raw edge of the opening.
- I. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.
- J. All openings in tops: 3/16" high raised die-formed edges.
- K. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½" deep, secured to the underside of the countertop.
- L. All "built-in" and "drop-in" counter equipment/appliances to have framing members at the perimeter of the opening.
- M. Scrap Basket: 18-gauge stainless steel construction 6½" x 6½" x 21¾" long. Top of container: 5/8" wide x ¼" high full perimeter flange with ¼" diameter stainless steel rod bail handle. Interior vertical corners coved on ½" radius. Countertop: Fitted with 6¾" square die-stamped opening.

2.8 DRAWERS

- A. Stainless Steel Liners: Component Hardware Model No. S80-2020 (20" x 20"), easily removable with drawer in the fully extended position.
- B. Drawer Frame: 16-gauge stainless steel flanged out at the top. Weld the frame to a double-panel 16-gauge stainless steel drawer front with full-length recessed pull at the top (similar profile as Garco Model No. R-1060) with closed ends.
- C. Channel-formed horizontal pull: ¾" turndown at the front and ends with ½" tight hem. The front edge of the pull: flush with the face of the drawer. Recess behind pull: sloped up on a 60° angle, terminating 1" below the bottom edge of pull.
- D. Mount drawer frame on Component Hardware Model No. S52-2020 self-closing slides, with Delrin bearings, full-depth of the fixture. Secure slides to the body or brackets to eliminate lateral movement in the extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides with Delrin bearings.
- E. Drawer enclosure in an Open Base Fixture: 18-gauge stainless steel flanged out at the top for attachment to the underside of the tabletop. The lower edge of the enclosure is flanged in toward the open bottom. Mount drawer slides to enclosure and brace as required. The face of the enclosure is to be the same length and height of the drawer face. Provide ¾" deep offset in front of the enclosure and 2½" from the underside of the tabletop for a flush-fitting appearance.

- F. Drawer enclosure on freestanding fixture: Full depth of table framing.
- G. Drawer enclosure in a Closed Base Fixture: Completely partitioned from the adjoining area. Drawer front: Flush fitting with the face of the body.
- H. Drawer Liners other than tool/utility: Bread Drawer: Component Hardware Model No. S83-2020; Refrigerated Drawer: Component Hardware Model No. S81-1520 stainless steel liner.
- I. Cash Drawer: Integral stainless-steel body, 3" deep.

2.9 FOOD WELLS (UNLESS SPECIFIED OTHERWISE)

- A. Food Warmer Controls: Remote-mounted in sloping recessed apron panel. The control panel is recessed 2½" from the bodyline at the top of the 60° slope and 1" at the lower edge. Terminate slope angle 2½" below the countertop. Mount panel on concealed piano hinge at bottom edge; secure with screws at upper corners.
- B. Manifold all warmer drains and extend to within the utility compartment for indirect waste connection. Install valve in the drain line and extend handle through compartment door.
- C. Removable 18-gauge stainless steel closure panel at the underside of warmers.
- D. 14-gauge stainless steel plate/utensil shelf full-length of hot food station unless noted otherwise: 10" below countertop x 9" deep, with rear panel coved up to the underside of the countertop; end panels turned up square. Front of shelf: Turned down 1½" and returned under for closure panel attachment.
- E. Food wells: Hatco Model No. HWBIBRT-FULD insulated food warmer (1200 watts, 208 volts, single phase) secured to the underside of 12" x 20" die-stamped countertop openings with thermal breaker mastic rope applied at the perimeter of food well flange.
- F. Soup Warmers: Hatco Model No. HWB-11QTD soup warmer secured to the underside of 11" diameter die stamped countertop opening with thermal breaker mastic rope applied at the perimeter of soup well flange. The maximum allowable temperature of the countertop at the contact surface is: 120°F. Each warmer: Equipped with one 11-quart stainless steel round insert and slotted cover.

2.10 SINKS

- A. 14-gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.
- B. Continuous exterior panels of multiple-compartment sinks: 14-gauge stainless steel filler panel welded ground and polished between compartments.
- C. Sinks (with overflow): Score and slope sink bottom ½" to die-stamped opening fitted with Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. 14-gauge stainless steel bracket: Welded to sink bottom for drain stem with 1½" handle clearance.

- D. Where sinks are installed in fixtures with Closed Base Body, provide a Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. (Sinks with dimensions larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14-gauge stainless steel bracket: welded to sink bottom with T & S Model No. BL-4740-1 guide bushing. Install on shortened drain stem, one T & S Model No. BL-4710-1 remote control stem assembly only (length as required) with Model No. 113-L universal joint and white blank button. Set drain control handle in Cambro Model PSB-6 bowl with bottom omitted (dress raw edge) to permit passage of drain handle—secure bowl in utility compartment door or body panel with clear silicone.
- E. When single-hole deck-mounted faucets are specified, install overflow fitting in the sidewall of the sink compartment and provide ell-fitting in connecting tubing.
- F. Flush Covers when specified: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated. Support clips: 1/4" stainless steel rod 2" long, formed at 45° with two 3/4" leg ends (1/4" long threaded ends). Insert rod clips through tight-clearance holes in the sink, seal watertight, and secure with stainless steel acorn nuts or tack-weld at the exterior of the sink wall. Set support clips 1/2" below the top. Provide a 14-gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: Adjacent to sink compartment, below countertop, or under drawer assembly.

2.11 TRAY SLIDES (UNLESS OTHERWISE SPECIFIED)

- A. Tray slides: 12" wide, solid 14-gauge stainless steel turned up 2" at the rear behind countertop turndown; turned down 4" at the front and free ends unless otherwise indicated.
- B. Three 1/4" high die-formed inverted "V" ridges at 4" OC, 2" from the leading edge, terminating 2" from ends of tray slide with tapered ridge ends.
- C. Ridges formed on radius: Equal-length segments with 2" separation between chords.
- D. Secure tray slides to countertop/body frame, same as "Countertops." Enclose the exposed underside of the tray slide with 18-gauge stainless steel.
- E. When indicated, project tray slides 2" beyond the serving countertop and return the entire width of the serving counter at free ends.
- F. All tray slides are to be provided and mounted per ADA requirements.

2.12 UTENSIL – WASH COUNTERS

- A. 14-gauge stainless steel; all free edges coved up 3" with 1 1/2" diameter rolled rim and bullnose corners.
- B. Edges of utensil-wash counters next to high fixtures or walls: Coved up 10" and sloped back 1 1/2" on 45° angle; 2 1/2" slope where piping occurs. Turn down 1" at the rear of splash and secure backsplash to the wall with 4" long 14-gauge stainless steel "Z" clip anchored to wall @ 36" OC. Vacuum breaker pockets: 4" long square turnback sections aligned with the slope break line.
- C. Exposed Rear Splash: 16-gauge stainless steel finished panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end of the splash and 1/2" turnback at the bottom of the panel. Secure the panel with concealed attachment and install bracing 24" OC.

- D. Cove all interior corners (horizontal/vertical) on $\frac{3}{4}$ " radius and slope tables $\frac{1}{8}$ " per foot, maintaining level crown.
- E. Brace utensil-wash counters with 1" x 4" 12-gauge stainless steel channels down the centerline of the top and between each pair of legs, with closed ends. Bracing: Secured to underside of dishtable with $\frac{1}{4}$ " studs welded 6" OC. maximum, with a chrome-plated washer, lock washer, and cap nut. Studs: Such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."
- F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match the top.
- G. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on a leg/bracket assembly.
- H. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with $\frac{3}{8}$ " stainless steel rod hose hanger.

2.13 DOORS

- A. 18-gauge x 1" stainless steel double pan-formed welded construction, insulated with 1" thick polyurethane boards. Seal the perimeter joint of the pans. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the Body.
- B. Channel-formed full-length horizontal recessed pull: $\frac{3}{4}$ " turndown at the front and ends with $\frac{1}{2}$ " tight hem. The front edge of the pull: Flush with the face of the door. Recess behind pull: Sloped up on a 60° angle and terminated 1" below the bottom edge of pull.
- C. Door Hardware
 - 1. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).
 - 2. Component Hardware Model No. 35-2000 Concealed Magnetic Catch.
 - 3. Component Hardware Model No. D30-4780 lock in the upper free corner of the door.
- D. Louvered opening: Cut-out opening size as indicated, turn in 1", and weld. All corners: Ground and polished.
 - 1. Full-height 18-gauge stainless steel louver with 1" vanes at 45°, $\frac{1}{2}$ " spacing. Perimeter channel-formed frame: $1\frac{1}{2}$ " x 1".
 - 2. 45° x 1" x $\frac{1}{2}$ " x opening width plus $\frac{1}{2}$ " 18-gauge stainless steel louver.
 - 3. Tack the louver flange's weld tab to the door's back panel.
- E. Drain handles opening: 6" diameter hole through the double pan to accommodate Cambro Model No. PSB-6 Bowl:
 - 1. Secure the bowl to the door panel with clear silicone.
 - 2. Omit the bottom of the bowl. Dress raw edges of opening for passage of drain handle.
 - 3. Exposed insulation at the penetration of the door pan: Painted black.

- F. Sliding Doors: fabricate same as Paragraph "A."
1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required. Secure to angle frame at the top of the underside.
 2. Front/rear door sheaves: Stainless steel $\frac{3}{4}$ " side-mounted door hangers; two (2) required per door.
 3. Recessed Vertical Pull at Upper Corner of Door: Component Hardware Model No. P63-1012.
 4. By-Passing Door Guides secured to bottom shelf: Component Hardware Model No. B62-1093.
 5. Door Stop at the bottom edge of door: Component Hardware Model No. B60-1086.
- G. Offset the lower horizontal framing member of the Closed Base Body/utility compressor compartment to align the door flush with the bottom of the Body.

2.14 CLOSED BASE BODIES

- A. Frame: Rigid-welded $1\frac{1}{2}$ " x $1\frac{1}{2}$ " x $\frac{1}{8}$ " galvanized steel angle forming a continuous structure around the top and bottom perimeters of the fixture, a post at each corner, studs spaced 48" OC maximum. The top of the frame is cross-braced with $1\frac{1}{2}$ " angles, 2'-0" OC maximum.
- B. 18-gauge stainless steel panels and trim with concealed attachment. All seams: Welded, ground, and polished.
- C. Exposed Vertical Corners: Rounded on $\frac{3}{4}$ " radius. Closed Base Bodies adjacent to walls or fixtures: square corners.
- D. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: Closed and sealed.
- E. Closed Base Bodies set on finished masonry platforms: closed and caulked at the underside of equipment overhang and bolted to the platform. Body overhang of the platform: 1" at free ends and 2" at the front and exposed rear sides.
- F. Closed Base Bodies not set on the platform: Component Hardware Model No. A54-2-6, 6" legs spaced 4'-0" OC maximum.

2.15 COMPRESSOR COMPARTMENTS

- A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.
- B. 10-gauge steel slide-out support: Channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on the solid platform: front-to-back slide-out support channels set 4" above the bottom for air circulation.

- C. Access Door: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full length of the top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: $\frac{3}{4}$ " turndown at front and face of the door. Recess behind pull slopes up on a 60° angle, terminating 1" below the bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.
- D. Access Doors Louver: Full-height, with $1\frac{1}{2}$ " x 1" x 18-gauge stainless steel channel-formed frame with welded corners. 18-gauge stainless steel louver. Submit a sample of the design for approval.

2.16 UTILITY COMPARTMENTS

- A. Closed Base Bodies or Pedestal Supports: Fitted with utility compartments wherever piping or wiring is required in/on the fixture.
- B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.
- C. Access Doors: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full-length of the top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: $\frac{3}{4}$ " turn down at the front of the door, a recess behind the pull slopes up on a 60° angle, terminating 1" below the bottom edge of the pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of the door with the face and bottom edge of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.
- D. No shelves of Closed Base Fixtures are to be penetrated.

2.17 UTENSIL RACKS

- A. Rack: $\frac{1}{4}$ " x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match the shape shown on drawings. Lowest band - 7'-6" AFF unless otherwise indicated.
- B. Ceiling Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing from band to 18" above the ceiling. Anti-sway bracing above the ceiling - $1\frac{1}{2}$ " Unistrut members. Tubing penetrations at the ceiling - Component Hardware Model No. A16-0206 stainless steel gussets.
- C. Table Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing extended thru countertop. Secure to closed base framing or cross rail/undershelf on the open base fixture. Tubing penetrations of countertops - integrally welded stainless steel inverted gusset.
- D. Utensil Rack Hooks - Component Hardware Model No. J77-4401 stainless steel hooks spaced 8" OC maximum.
- E. Electrical Receptacle: NEMA No. 5-20-R or as noted. Mount in fully welded $3\frac{1}{2}$ " x $5\frac{1}{2}$ " x 3" 14-gauge stainless steel enclosure with $\frac{1}{2}$ " radius corners. Stainless steel cover plate to fit specified receptacle. Pre-wire thru tubular support for final connection above the ceiling by Division 26.

2.18 CASHIER / SERVING COUNTERS

- A. Exterior Body Panels, when specified: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.
- B. Position, size, and finish horizontal or vertical reveal as Architect directs.
- C. Secure panels to counter body framing in a concealed manner. Install removable panels with "Z" clips overlapping body framing members.
- D. Hinged doors in exterior body panel(s) - Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three (3) required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with the submittal.
- E. Cashier counter to have 16-gauge s/s intermediate shelf, turned down 1 1/2" with tight hem at front. Cove up 2" at rear and sides. Brace undershelf with 1" x 4" 14-gauge stainless steel channel at the longitudinal centerline. Provide an outlet for power/data within the body above the intermediate shelf. Provide cash drawer inserts per district standards.
- F. Sneeze Guards to be adjustable and meet NSF standards.

2.19 OPEN BASE STRUCTURES

- A. 1-5/8" OD x 16-gauge seamless stainless-steel tubing legs beveled at the bottom. 1¼" OD cross rails fully welded (360° smooth and polished) to legs at 10" AFF, OC.
- B. Top of Leg: Inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.
- C. Bullet Foot: Component Hardware Model No. A10-0851.
- D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to the floor with non-corrosive bolts.
- E. Table Bases: Maximum leg spacing of 6'-0" OC; dishtable and utensil wash counter bases at 5'-0" OC.
- F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): Tubular legs at the front side only with Component Hardware Model No. A10-0854 flanged feet anchored to the floor with non-corrosive bolts. Front-to-back cross rail: fitted into Component Hardware Model No. A20-0406 circular gusset secured to the wall with non-corrosive bolts.

2.20 UNDER SHELVES

- A. Open Base Structures: 16-gauge stainless steel turned down 1½" with tight hem at the bottom. Notch all corners to fit tubular legs and weld from the underside to fill the gap, grind, and polish. Cove up 2" at the rear or ends adjacent to wall, columns, refrigerators, etc. The turn-up at freestanding fixtures is to be hemmed tight to the bottom of the turndown. Brace undershelf with 1" x 4" 14-gauge stainless steel channel at the longitudinal centerline and each intermediate pair of legs.

- B. Open Base Structure specified to be supported by brackets at the rear side only (not completely cantilevered): 16-gauge stainless steel turned down 1 ½" at free sides with tight hem at the bottom edge. Notch all corners to fit tubular legs as required and weld from the underside to fill the gap, grind, and polish. Cove up 2" at rear ends, as indicated. Fill the gap at the front-to-back rail, grind, and polish. Brace undershelf with 1" x 4" x 1" 14-gauge stainless steel channel at longitudinal centerline between front to back rails.
- C. Closed Base Fixtures: 16-gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: Turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.
 - 1. Shelves: Turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.
 - 2. All shelf partitions at exposed ends of cabinet bodies or interiors: Free of exposed framing members.
 - 3. Reinforce shelves with full-length 1" x 4" x 14-gauge stainless steel closed hat channel.
 - 4. Unless otherwise noted, all closed base undershelves must be 22" deep and clear.
 - 5. Fully weld smooth and polish the vertical seam of the shelf turndown/turn up with the face of the body partition.
 - 6. Seal the vertical seam of the square turn-in at the exposed interior of open shelf sections.

2.21 ANCHOR PLATES / WOOD GROUNDS

- A. Behind the finished surface, wherever building walls, partitions, or ceiling construction will not accommodate direct attachment of equipment such as over shelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 11 40 00.
- B. Anchor Plates: Not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.
- C. Wood Grounds: Length required by fixture, component, or device, 24" wide x ¾" thick plywood secured to partition system before gypsum board installation.
- D. Above ceiling supports: Structural shapes (4" x 8.0 lb. channel) suspended from the structure. Maximum height 15'-0" AFF. Size: width of equipment x length of equipment plus 6'-0". Cross bracing at 6'-0" OC maximum.

2.22 OVER SHELVES

- A. 16-gauge stainless steel with free edges turned down 1" with ½" tight hem at the bottom—¾" radius at free corners.
- B. Turn up 2" raw at walls and sides with a horizontal coved corner at the rear. Round front corners of turn up on ¾" radius.
- C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14-gauge stainless steel closed hat channel full-length of the shelf.

- D. Wall-Mounted Shelves: 16-gauge stainless steel brackets 48" OC maximum, set in 6" from ends.
- E. Freestanding Shelves: Where splash is required at free over shelves, turn up square 2" at ends, cove up at the rear, and hem tight to lower edge of front turndown. Weld exposed corners.
 - 1. Freestanding over shelves: 16-gauge stainless steel cantilevered brackets at the rear of the table; double-cantilevered brackets at the center of the table. Posts for cantilevered over shelves are 1-5/8" OD x 16-gauge stainless steel secured to the underframe, 4'-0" OC. Ends of shelves: Secured to adjacent wall/fixture or mounted on 1 1/4" diameter stainless steel posts.
 - 2. Freestanding over shelves not on cantilevered brackets: 1 1/4" OD x 16-gauge stainless steel posts, each pair at 4'-0" OC maximum.
- F. Baker Table Over shelves: Supported 18" above the top with 1 1/4" OD stainless steel tubular supports with channel shoe secured to risers.
- G. Glass/Cup Rack Over shelf at Dishtables: 14-gauge stainless steel with 1 1/2" deep "vee" trough at free long sides with 1" tight hem inside the trough. Provide a 1/2" marine edge at free ends and; a 4" splash at the wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" OD stainless steel tubing supports from the structure above the ceiling at front edge, 60" OC at each end.
 - 1. Install at both ends a 1/2" stainless steel drain tube (connecting both vee-troughs) extended to the dishtable surface through splash turnback.
 - 2. Rack-rest: horizontal full-length 1-5/8" OD stainless steel tubing supported at 10" OC above shelf (8" OC for double service shelf) by 1 1/4" OD stainless steel tubing with closed ends. Support tubing: welded, ground, and polished, spaced 60" OC.
 - 3. Rack-rest supports to wall: 4" x 4" x 10-gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.23 HIGHLIGHTING

- A. Polish the following vertical surfaces to a No. 8 finish:
 - 1. Serving and display shelf turndowns.
 - 2. Conveyor and dish/tray deposit station turndowns/frame.
 - 3. Tray slide turndowns.

2.24 SHOP / FIELD JOINTS

- A. Field joints: The least number is used only when equipment size must be limited for building or interior space access.
- B. Stainless steel tops (including edges and splashes): Fully welded, ground, and polished to match adjacent surfaces.
- C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of the field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw joints: located and noted on shop drawings.

- D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to the back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide a flat backing surface for a joint with the angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" OC.
- E. Closed Base Bodies: Draw-type with hairline seam fully field-welded.
- F. Millwork: Plastic laminated joints shall be dowelled, glued, and draw-bolted with fasteners.
- G. Solid Polymer: Surfaces drawn tight, filled, sanded, and finished to match adjacent surfaces.

2.25 PRE-APPROVED KITCHEN EQUIPMENT CONTRACTORS

- A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.
- B. **Any contractor requesting inclusion within this bid must submit AIA form 305 a minimum of 14 days before the bid date for review or as required by Architect.**
 - 1. Stafford Smith, Mr. JP Garcia, 7129 North Loop East, Houston, TX 77028, (713) 892-5001, E-mail: jpgarcia@staffordsmith.com
 - 2. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, (713) 466-8722, Fax: (713) 466-0166
 - 3. Kirby Restaurant Supply, Mr. Billy Anderson, 809 S. Eastman Road, Longview, Texas 75602, Phone: (903) 757-2723, Fax: (903) 757-9519, Email: billya@kirbyrestaurantsup.com
 - 4. Mission Restaurant Supply, 1126 S. St. Mary's Street, San Antonio, Texas 78210. Mr. Brian Mosher, Phone (210) 354-0690, Fax (210) 354-0746, E-mail: brianM@missionrs.com
 - 5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, (409) 769-1199, E-mail: terry@kommercialkitchens.com
 - 6. Amundsen Commercial Kitchens, Mr. Lewis Beville, 105 Montie, Longview, TX 75604, (903) 576-6354, E-mail: lewis@afeok.com
 - 7. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: (501) 455-2552, Fax: (501) 455-0802, E-mail: tim@supremefixture.com

2.26 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS

- A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.
- B. **Any supplier requesting inclusion within this bid must submit AIA form 305 at least 14 days before the bid date for review or as required by Architect.**
 - 1. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, (713) 466-8722, Fax: (713) 466-0166

2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, (832) 767-5287
3. Mission Restaurant Supply, 1126 S. St. Mary's Street, San Antonio, Texas 78210. Mr. Brian Mosher, Phone (210) 354-0690, Fax (210) 354-0746, E-mail: brianM@missionrs.com

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

- A. Supervision: Provide a skilled and proficient foreman or supervisor who shall remain on the job during the entire installation.
- B. Delivery: Coordinate with the progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:
 1. Field-Assembled Fixed Equipment integrated into the structure (e.g., cold storage assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job site when directed by the General Contractor and installed/protected accordingly.
 2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.
 3. Major Movable Equipment: delivered, when possible, to inventory in a secured area for interim job-site storage or, if the secured area is unavailable when fixed equipment installation/clean-up has been completed.
 4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) should be delivered only when the Owner is prepared to receive and inventory such items.
- C. Installation: performed by the manufacturer of custom fabricated fixtures.
 1. Assemble, square, level, and ready all items for the final utility connections.
 2. Cut neatly around obstructions to provide sanitary conditions.
 3. Where gaps of 1/4" or less occur adjacent to or between equipment, insert rope backing and smoothly applied General Electric construction sealant Series SE-1200 silicone mastic (silver color). Mask both sides of the gap for neat sealant application and remove excess. If space exceeds 1/4," neatly install 18-gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.
 4. Refrigeration coil drain line runs to an indirect drain connection greater than 2" from the face of the wall or panel: Either of the following field procedures:
 - a. Trench the floor and provide a 6" wide x 2" deep 16-gauge stainless steel sloping (-1" to -2") trough from the face of the cooler/freezer wall to the body of the floor sink/floor drain. Trough: turned up 4" at the wall; 3/4" flange with 1/2" turndown at both long sides. Set trough in waterproof mastic and seal 1" OD drain tube penetration into floor sink/floor drain at -2 1/2" BFF. Patch the floor to match adjacent material/surface.

- b. Provide 12" x 6" x 2" deep 16-gauge stainless steel condensate pan mounted to cooler/freezer wall at 6" AFF clear. Trench the floor and install a 1" OD drain line from the bottom of the pan to the body of the floor sink/drain. Slope drain line 1/4" per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

- 1. Fabricated fixtures: Fiberboard or plywood taped to tops and exposed body panels/components.
- 2. Manufactured Equipment: Fiberboard or plywood taped as required by equipment shape and installation-access requirements.
- 3. Prohibited use of equipment: Tool and materials storage, workbench, scaffold, stacking area, etc.
- 4. Damaged Equipment: Immediately documented and submitted to the Owner with the Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

- A. Clean up and remove all debris from this Work from the job site as the installation progresses.
- B. Lubricate and adjust drawer slides, hinges, and casters.
- C. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.
- D. Clean or replace faucet aerators and line strainers.
- E. Touch-up damage to painted finishes.
- F. Startup and check the operation of all refrigeration systems for at least 72 hours before acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

- A. Carefully test, adjust, and regulate all equipment following the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments, and performance are in full compliance.
- B. Provide the Owner or food service Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected equipment items and attendees with the Owner at least two weeks before the demonstration starts.

3.4 FINAL OBSERVATION

- A. Final observation will be made when the Contractor certifies that they have completed their work, thoroughly reviewed the installation/operation of each item in the contract, and found it to comply with the Construction Documents.
- B. Repetitive final observations (more than two) and all costs associated with it which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a \$70.00/hr and expense basis.

PART 4 - EQUIPMENT SCHEDULE

- 4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS:** Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.
- 4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT:** Arrangement and configuration as shown on Plans, Elevations, Detail Drawings, and outlined in Specifications.
- 4.3 REFER TO DRAWINGS:** For unit quantities and plumbing, electrical or mechanical provisions are required, including the manufacturer's optional voltages, wattages, burner capacities, etc.
- 4.4 REFER TO PART 2 – PRODUCTS:** For accessories, fittings, requirements, and procedures related to the listed buy-out and fabricated equipment.
- 4.5 ALTERNATE MANUFACTURER REQUIREMENTS:** A specific product manufactured by the listed pre-approved equals shown under Section 4.7 Food Service Equipment are acceptable only if the specific product can evidence compliance with the specified line items and the contract documents (Refer to Section 1.6; Sub-Section A.).
- 4.6 RE-USED EXISTING EQUIPMENT IF SHOWN**
- A. Existing equipment scheduled for re-use is to be inventoried and documented that equipment is in operating condition once Kitchen Contractor has taken ownership.
 - B. Provide pictures of all equipment once inventoried and issue them to the architect to ensure that equipment has not been damaged.
 - C. Verify the locations of all equipment with the owner.
 - D. Existing equipment that is to be reused may need parts or accessories for proper and complete operation. Submit a report listing all items with pricing for approval to allow complete installation.
 - E. Utility disconnection and re-connection: Under Divisions 22 and 26. Kitchen Contractor to verify utility requirements of existing equipment and coordinate with Foodservice Design Professionals (FDP) as required. All utilities not scheduled for re-use must be capped and covered by required disciplines.
 - F. Disassembly, removal, transportation, and relocation: under this Section and scheduled with General Contractor. The owner's representative must be present and coordinate the date/time with the owner.
 - G. Thoroughly clean inside and out before relocation.
 - H. Review functional parts (e.g., doors, controls, heating elements, compressors, etc.) and submit a report of required repairs and cost estimates. Any finishes or equipment damaged due to construction will be repaired as required.
 - I. Existing equipment not scheduled for reuse is to be carefully removed/relocated by the Kitchen Contractor per the Owner's direction. Kitchen Contractor to coordinate the date/time with General Contractor and Owner.
 - J. Removal or replacement of existing equipment is to be scheduled for times of least interruption and inconvenience to the food service operation. Submit the proposed time frame schedule, task sequence, and process for approval before starting work.

- K. Kitchen Contractor to verify size and shape for all existing re-used equipment and coordinate with Foodservice Design Professionals (FDP) as required.
- L. Any modification(s) required/desired for re-used existing equipment to be verified by the Kitchen Contractor. Before the changes are made, all modifications must be approved by the Owner and Foodservice Design Professionals (FDP).
- M. The KEC is to verify and coordinate all the utility requirements with the construction documents as required. Refer to the general specifications regarding conflicts.

4.7 FOOD SERVICE EQUIPMENT

- A. All equipment is to have a performance check from factory-authorized personnel. Warranties will begin on the day of the performance check.
- B. All equipment and internal components should be of domestic origin where possible.
- C. Architectural coordination items for potential Food Service color, material or signage selections:
 - 1. Countertops: Stone (stainless steel is provided unless otherwise specified)
 - 2. Tray slides: Corian or Stone (stainless steel is provided unless otherwise specified)
 - 3. Counter fronts: Ceramic tile, 3 Form, or Plastic Laminate
 - 4. Sneeze Guards: Stone insets
 - 5. General color, material and graphic selections:
 - a. Display Air Screen Merchandisers – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)
 - b. Bakery Display Cases – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)
 - c. Pass Thru or Reach In Holding Cabinets - Color selection: Powder Coat (Mfg.: True) or Plastic Laminate (Mfg.: Traulsen) (Stainless steel is provided unless otherwise specified)
 - d. Hanging Heat Lamps – Track and Fixture color selection
 - e. Heated Merchandisers
 - f. Portable Guide Rails – Stanchion and Belt color selection
 - g. Popcorn machine – Signage selection
 - h. Bottle Cooler – Signage selection
 - i. Graphics Package information
 - j. Hot Food Well covers
- D. General Architectural finishes:
 - 1. Walls: Ceramic Tile, Flat FRP, or Molded FRP (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)

2. Ceilings: Removable Vinyl Face Tile (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)
3. Floors: Tile, Epoxy, or Rubberized flooring system (Smooth, impervious, easily cleanable and slip resistant as approved by local jurisdiction) (Coordinate floor tile transition at serving lines)
4. Floors: Cold Storage Assembly – Extend kitchen floor flush into Cold Storage Assembly with coved base
5. Furr Downs above Serving Counters

EQUIPMENT SCHEDULE

ITEM NO. 191

REACH-IN HEATED CABINET- 2DR

QUANTITY 4

Manufacturer: Traulsen
Model: HF-232W
Size and Shape: Refer to drawings
Alternate: ---

1. Anodized aluminum interior and S/S exterior.
2. Interior lights with bulbs.
3. Exterior digital thermometer.
4. Locking hardware.
5. Universal 18" x 26" and 12" x 20" pan files on 4" centers in all sections.
6. 6" high adjustable S/S legs.
7. Furnish start-up and three (3) years repair service, including parts and labor.
8. Full height glass doors hinged as per plan.
9. Re-hinging feature.

ITEM NO. 192

REACH-IN REFRIGERATOR - 1DR

QUANTITY 4

Manufacturer: Traulsen
Model: HT-132WUT
Size and Shape: Refer to drawings
Alternate: ---

1. Anodized aluminum interior and S/S exterior.
2. Interior lights with bulbs.
3. Exterior digital thermometer.
4. Locking hardware.
5. Universal 18" x 26" and 12" x 20" pan files on 4" centers in all sections.
6. 6" high adjustable S/S legs.
7. Furnish start-up and three (3) years repair service, including parts and labor.
8. Five (5) Year compressor warranty.
9. Omit plug. Unit to be Hard Wired.
10. Full height glass doors hinged as per plan.
11. Re-hinging feature.
12. Special Instructions: One (1) unit to be connected to back-up generator per TISD standards.

ITEM NO. 201.1**SERVING COUNTER****QUANTITY 2**

Manufacturer: Mod-U-Serve
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. CONSTRUCTION BASE:

- a. Continuous semi-open base, angle iron frame construction; utility chase within the counter. All electrical conduits and plumbing are to be within utility chase as required. Utility chase to be fully accessible from the operator side of the counter with removable stainless-steel panels.
- b. All electrical is to be pre-wired to the load center. Electrical is to be in an electrical conduit pipe, and flex conduit is to be kept to a minimum. Exposed conduit will not be accepted. All wiring to be numbered at all junctions per circuit. A wiring diagram is to be provided at each load center door. All receptacles mounted in the counter are to be recess mounted and labeled.
- c. Cashier stations to be integral with counter, closed base when located on the operator's side of counter, open base when located on the operator side of the counter. Provide lockable cashier drawer with cash till, undershelf to accommodate owner's POS System, and an outlet to accommodate POS system and data line.
- d. Stainless steel removable intermediate shelves and fully welded undershelves where possible.
- e. Dedicated recessed receptacle to accommodate beverage merchandisers, coordinate location with drawings.
- f. Provide a remote on/off switch for beverage merchandisers if the standard location is not accessible.
- g. Dedicated receptacle for any/all countertop equipment with grommets holes. Coordinate location with equipment.
- h. Adjustable kickplates.

2. COUNTERTOP FINISHES:

- a. 48" front to back continuous countertop, tray slide to be integral with countertop.
- b. Solid Stone Surface countertop located at 34" A.F.F. Verify selection prior to bidding if not specified. Submit a 12" X12" sample to the architect for approval.

3. COUNTER COMPONENTS:

- a. One (1) lot Hatco HCWBI-2DA Drop-in Hot/Cold food wells 3000-watt bottom mount insulated hot/cold food wells located per drawings. Recess countertop at hot food wells to accommodate sheet pan. Manifold all drains to one open/close valve located below the counter in an accessible location. Temperature at each well to be independently controlled via switch.
- b. Deck mount single pantry fill faucet T&S Model no. B-0208.
- c. Manifolded drains lead to a single 3/4" turn ball valve mounted in a full stainless steel housing. Drain valve is to be located on the operator's side for ease of access.
- d. One (1) lot Hatco drop-in frost top to accommodate 18" x 26" sheet pan capacity unless counter drawings show otherwise. Provide stone inset and verify selection with the architect.
- e. Provide one (1) lot Hatco Drop-in GRSBF-O model pizza shelf. Size per drawing.
- f. Hot food well solid surface covers: color selection to match counter top.

- g. Stainless steel louvered panels to be provided on the operator's side only at compressor locations.
 - h. One (1) LOT 2-Tier Frost top surface located in sneeze guard glass shelf, refrigeration to be self-contained with compressor housing located at undershelf. model designed to accommodate 18" x 26" sheet pans Refer to drawings for sizes.
4. SNEEZE GUARDS:
- a. Elite IV sneeze guards, mirror finish, single tier at hot food wells, and two-tier at cold pans/frost tops. 3/8" Tempered glass. Height to be 18" above countertop. Glass to be adjustable to accommodate self and full-service operation. Heat lamps with lights located at hot food well and heated tops, lights over the cold sections. Size to accommodate equipment. Sneeze guards to meet NSF requirements. Mirror finishes at sneeze guards.
 - b. Brass Smith X-guard hot food sneeze guard. Front posts and glass only. Glass to be adjustable to accommodate self and full-service operation. No heat lamp or display light. Size to accommodate equipment. Sneeze guards to meet NSF requirements. Mirror finishes at sneeze guards.
 - c. Sneeze guards to be secured to base of counter and welded to countertop. If stone top construction, extend thru countertop and secure to base, provide matching color sealant to match countertop.
 - d. Sneeze guards to meet all NSF and local health code requirements.
5. COUNTER FRONT FINISHES
- a. Counter front to consist of removable 3 Form Varia Ecoresin decor panels with full-size LED panel located behind 3Form finish, stainless steel body reveal between panels. Color selection by owner/architect. Submit a 12" X 12" panel to the architect for approval.
 - b. Counters to be factory installed, manufacturer to provide floor template and coordinate with mep and furr down requirements.
 - c. Manufacturers are to bid all items per specifications; deviations from the specified manufacturers or fabrication will not be accepted.
 - d. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.

ITEM NO. 201.2**SERVING COUNTER****QUANTITY 2**

Manufacturer: Mod-U-Serve
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. CONSTRUCTION BASE:

- a. Continuous semi-open base, angle iron frame construction; utility chase within the counter. All electrical conduits and plumbing are to be within utility chase as required. Utility chase to be fully accessible from the operator side of the counter with removable stainless steel panels.
- b. All electrical is to be pre-wired to the load center. Electrical is to be in an electrical conduit pipe, and flex conduit is to be kept to a minimum. Exposed conduit will not be accepted. All wiring to be numbered at all junctions per circuit. A wiring diagram is to be provided at each load center door. All receptacles mounted in the counter are to be recess mounted and labeled.
- c. Cashier stations to be integral with counter, closed base when located on the customer side of counter, open base when located on the operator side of the counter. Provide lockable cashier drawer with cash till, undershelf to accommodate owner's POS System, and an outlet to accommodate POS system and data line.
- d. Stainless steel removable intermediate shelves and fully welded undershelves where possible.
- e. Dedicated recessed receptacle to accommodate beverage merchandisers, coordinate location with drawings.
- f. Provide a remote on/off switch for beverage merchandisers if the standard location is not accessible.
- g. Dedicated receptacle for any/all countertop equipment with grommets holes. Coordinate location with equipment.
- h. Adjustable kickplates.

2. COUNTERTOP FINISHES:

- a. 48" front to back continuous countertop, tray slide to be integral with countertop.
- b. Solid Stone Surface countertop located at 34" A.F.F. Verify selection prior to bidding if not specified. Submit a 12" X12" sample to the architect for approval.
- c. COUNTER COMPONENTS:
- d. One (1) lot Hatco HCWBI-2DA Drop-in Hot/Cold food wells 3000-watt bottom mount insulated hot/cold food wells located per drawings. Recess countertop at hot food wells to accommodate sheet pan. Manifold all drains to one open/close valve located below the counter in an accessible location. Temperature at each well to be independently controlled via switch.
- e. Deck mount single pantry fill faucet T&S Model no. B-0208.
- f. Manifolded drains lead to a single 3/4" turn ball valve mounted in a full stainless-steel housing. Drain valve is to be located on the operator's side for ease of access.
- g. . One (1) lot Hatco drop-in frost top to accommodate 18" x 26" sheet pan capacity unless counter drawings show otherwise. Provide stone inset and verify selection with the architect.
- h. Hot food well solid surface covers: color selection to match counter top.

- i. Stainless steel louvered panels to be provided on the operator's side only at compressor locations.
 - j. One (1) LOT 2-Tier Frost top surface located in sneeze guard glass shelf, refrigeration to be self-contained with compressor housing located at undershelf. model designed to accommodate 18" x 26" sheet pans Refer to drawings for sizes.
3. **SNEEZE GUARDS:**
- a. Elite IV sneeze guards, mirror finish, single tier at hot food wells, and two-tier at cold pans/frost tops. 3/8" Tempered glass. Height to be 18" above countertop. Glass to be adjustable to accommodate self and full-service operation. Heat lamps with lights located at hot food well and heated tops, lights over the cold sections. Size to accommodate equipment. Sneeze guards to meet NSF requirements. Mirror finishes at sneeze guards.
 - b. Brass Smith X-guard hot food sneeze guard. Front posts and glass only. Glass to be adjustable to accommodate self and full-service operation. No heat lamp or display light. Size to accommodate equipment. Sneeze guards to meet NSF requirements. Mirror finishes at sneeze guards.
 - c. Sneeze guards to be secured to base of counter and welded to countertop. If stone top construction, extend thru countertop and secure to base, provide matching color sealant to match countertop.
 - d. Sneeze guards to meet all NSF and local health code requirements.
4. **COUNTER FRONT FINISHES:**
- a. Counter front to consist of removable 3 Form Varia Ecoresin decor panels with full-size LED panel located behind 3Form finish, stainless steel body reveal between panels. Color selection by owner/architect. Submit a 12" X 12" panel to the architect for approval.
 - b. Counters to be factory installed, manufacturer to provide floor template and coordinate with mep and furr down requirements.
 - c. Manufacturers are to bid all items per specifications; deviations from the specified manufacturers or fabrication will not be accepted.
 - d. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.

ITEM NO. 201.3**SERVING COUNTER****QUANTITY 2**

Manufacturer: Mod-U-Serve
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. CONSTRUCTION BASE:

- a. Continuous semi-open base, angle iron frame construction; utility chase within the counter. All electrical conduits and plumbing are to be within utility chase as required. Utility chase to be fully accessible from the operator side of the counter with removable stainless-steel panels.
- b. All electrical is to be pre-wired to the load center. Electrical is to be in an electrical conduit pipe, and flex conduit is to be kept to a minimum. Exposed conduit will not be accepted. All wiring to be numbered at all junctions per circuit. A wiring diagram is to be provided at each load center door. All receptacles mounted in the counter are to be recess mounted and labeled.
- c. Cashier stations to be integral with counter, closed base when located on the customer side of counter, open base when located on the operator side of the counter. Provide lockable cashier drawer with cash till, undershelf to accommodate owner's POS System, and an outlet to accommodate POS system and data line.
- d. Stainless steel removable intermediate shelves and fully welded undershelves where possible.
- e. Dedicated recessed receptacle to accommodate beverage merchandisers, coordinate location with drawings.
- f. Provide a remote on/off switch for beverage merchandisers if the standard location is not accessible.
- g. Dedicated receptacle for any/all countertop equipment with grommets holes. Coordinate location with equipment.
- h. Adjustable kickplates.

2. COUNTERTOP FINISHES:

- a. 48" front to back continuous countertop, tray slide to be integral with countertop.
- b. Solid Stone Surface countertop located at 34" A.F.F. Verify selection prior to bidding if not specified. Submit a 12" X12" sample to the architect for approval.

3. COUNTER COMPONENTS:

- a. One (1) lot Hatco HCWBI-5DA Drop-in Hot/Cold food wells 3000-watt bottom mount insulated hot/cold food wells located per drawings. Recess countertop at hot food wells to accommodate sheet pan. Manifold all drains to one open/close valve located below the counter in an accessible location. Temperature at each well to be independently controlled via switch.
- b. Deck mount single pantry fill faucet T&S Model no. B-0208.
- c. Manifolded drains lead to a single 3/4" turn ball valve mounted in a full stainless-steel housing. Drain valve is to be located on the operator's side for ease of access.
- d. One (1) lot Hatco drop-in frost top to accommodate 18" x 26" sheet pan capacity unless counter drawings show otherwise. Provide stone inset and verify selection with the architect.
- e. Provide one (1) lot Hatco Drop-in GRSBF-O model pizza shelf. Size per drawing.
- f. Hot food well solid surface covers: color selection to match counter top.

- g. Stainless steel louvered panels to be provided on the operator's side only at compressor locations.
 - h. One (1) LOT 2-Tier Frost top surface located in sneeze guard glass shelf, refrigeration to be self-contained with compressor housing located at undershelf. model designed to accommodate 18" x 26" sheet pans Refer to drawings for sizes.
4. **SNEEZE GUARDS:**
- a. Elite IV sneeze guards, mirror finish, single tier at hot food wells, and two-tier at cold pans/frost tops. 3/8" Tempered glass. Height to be 18" above countertop. Glass to be adjustable to accommodate self and full-service operation. Heat lamps with lights located at hot food well and heated tops, lights over the cold sections. Size to accommodate equipment. Sneeze guards to meet NSF requirements. Mirror finishes at sneeze guards.
 - b. Brass Smith X-guard hot food sneeze guard. Front posts and glass only. Glass to be adjustable to accommodate self and full-service operation. No heat lamp or display light. Size to accommodate equipment. Sneeze guards to meet NSF requirements. Mirror finishes at sneeze guards.
 - c. Sneeze guards to be secured to base of counter and welded to countertop. If stone top construction, extend thru countertop and secure to base, provide matching color sealant to match countertop.
 - d. Sneeze guards to meet all NSF and local health code requirements.
5. **COUNTER FRONT FINISHES:**
- a. Counter front to consist of removable 3 Form Varia Ecoresin decor panels with full-size LED panel located behind 3Form finish, stainless steel body reveal between panels. Color selection by owner/architect. Submit a 12" X 12" panel to the architect for approval.
 - b. Backer board finish installed by the manufacturer to accept tile by G.C. Coordinate finish with GC.
 - c. Counters to be factory installed, manufacturer to provide floor template and coordinate with mep and furr down requirements.
 - d. Manufacturers are to bid all items per specifications; deviations from the specified manufacturers or fabrication will not be accepted.
 - e. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.

ITEM NO. 204**HEATED MERCHANDISER - 40"****QUANTITY 2**

Manufacturer: Hatco
Model: HZMS-36D (slanted)
Size and Shape: Refer to drawings
Alternate: ---

1. Refer to drawings for size.
2. LED red accent light at support post.

ITEM NO. 207**48 REAR LOAD REF MERCHANDISER MILK CASE****QUANTITY 3**

Manufacturer: RPI Vienna
Model: VIAS4+4-34-R-SQ-SC-INS PRO (M)
Size and Shape: Refer to drawings
Alternate: Federal LMDM4878SC

1. 48" slide-in air screen merchandiser with rear loading doors. Recess bottom compartment to accommodate milk crates.
2. Hinged rear door, to be hinged per plans in lieu of sliding doors.
3. Roll up security door.
4. Fully insulated glass to reduce condensation.
5. One-way mirror backed with hinged rear loading doors.
6. Two (2) tempered glass shelves with lights
7. Locate recessed on/off and light switch in back side of unit, accessible to operator.
8. Five (5) Year compressor part warranty.
9. Drain to floor sink. Floor sink to be located below Merchandiser. .
10. KEC to verify unit is 5-6' away from air vents. Coordinate in field.
11. Glass sides, door windows and perimeter of doors to be heated.
12. Cord and plug assembly.
13. Stainless steel trim as required to seal gaps at counters.
14. Provide finished stainless-steel front and sides if unit is freestanding in lieu of a counter slide-in.
15. Provide submittal shop drawing for review by consultant.
16. **Special Instruction:** Start-up and calibration of unit must be by factory authorized service agency, prior to customer demonstration. K.E.C. to coordinate 18" height clearance at top of unit.

ITEM NO. 208**HANGING HEAT LAMPS****QUANTITY 2**

Manufacturer: Hatco
Model: 725RT
Size and Shape: Refer to drawings
Alternate: ---

1. Ceiling mounted retractable heat lamps.
2. Heat lamp track adapter.
3. Verify color of track and fixture assembly with architect.
4. On/off switch located on light assembly.
5. Interconnect to wall mounted light switch by Division 26.
6. Locate per drawings.
7. Coordinate with overhead furr down and serving counter as required.
8. **Special Instruction:** Section 114000 to coordinate with the General Contractor required wall blocking and electrical circuits to accept mounting of heat lamps.

ITEM NO. 214**CASH REGISTER****QUANTITY 6**

Manufacturer: Owner Furnished
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

ITEM NO. 249**THREE COMPARTMENT SINK****QUANTITY 1**

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14-gauge S/S 3" high 1-1/2" rolled rim at free sides, 10" high splash at walls.
2. Open base construction.
3. Omit rear rail at sink.
4. Three (3) 30" x 26" x 15" deep sink compartment.
5. Two (2) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for 3/4" hot and cold-water connections.
6. Three (3) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18-gauge S/S bracket for drain handle welded to sink bottom.
7. 12" deep single post mounted perforated overshef mounted at 18" above countertop.
8. 18-gaugebutt joint wall panel from splash to underside of shelf.
9. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x 1/4" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center.
10. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray rinse by owner.
11. Omit front rail at hose bibb.
12. 16-gauge S/S undershef as per drawings.
13. Flanged feet at front only of counter.
14. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

ITEM NO. 255**MOBILE DRYING RACK****QUANTITY 3**

Manufacturer: Cambro
Model: Camshelving Premium
Size and Shape: Refer to drawings
Alternate: ---

1. Four (4) tier, includes two (2) drop-ins and (1) cutting board/tray drying rack, built in Microban antimicrobial product protection.
2. Two (2) no. 5MPX casters per unit.
3. Two (2) no. 5MPBX locking casters per unit.

ITEM NO. 260

HAND SINK

QUANTITY 4

Manufacturer: Advance Tabco
Model: 7-PS-50
Size and Shape: Refer to drawings
Alternate: ---

1. 20-gauge stainless steel construction.
2. Basket drains and wall bracket.
3. Gooseneck faucet with wrist handles.
4. Soap and towel dispensers by Owner.
5. P-Trap assembly, delete open/close drain valve.
6. Custom fabricated removable end splashes on sides as required by code. height same as rear splash.
7. Trade contractor to provide temperature adjustment valves as required.

END OF EQUIPMENT SCHEDULE

SECTION 11 57 00

SHOP AND MISCELLANEOUS EQUIPMENT (ADD 03)

CONDITIONS OF THE CONTRACT, SECTIONS AA THROUGH CB AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD Request for Proposal and section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Miscellaneous equipment at specialty areas

1.2 SUBMITTALS

- A. Provide all submittals in accordance with Section 01 33 00 – Submittal Procedures.
- B. Shop Drawings:
 - 01 Manufacturer's specifications and other data needed to prove compliance with specified requirements.
 - 02 Manufacturer's installation instructions.
 - 03 Product warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Wide Three Door Floral Coolers:
 - 01 Wide three Door Floral cooler 77" length x 32" deep x 75" high, 115 volt, with self-closing lockable glass doors, two rows of adjustable shelves, condensate evaporator pan.
 - 02 Manufacturer – Bush Refrigeration or Approved Equal.
- B. Grooming In Line Bathing Tub
 - 01 Manufacturer – Groomer's Best Inc., 616 S Sioux Blvd., Brandon, SD 57005, 605-582-3013, or approved equal.
 - 02 Model: GB48IN - 48" In line stainless steel bathing tub with center drain and removable non-slip ramp
 - 03 Warranty: (3) Three Year
- C. Veterinary Small Animal Kennels:
 - 01 Manufacturer – Pet Edge, or approved equal.
 - 02 6 Unit Cage Bank, @ large on bottom with 4 medium on top.
 - 03 Stainless Steel construction with solid aluminum gates of ½" square frame and 3/8" rod removable doors on stainless steel hardware. Bank size of 88" wide x 27-1/4" deep x 61" tall.
 - 04 Unit to be on casters

- D. Stainless Steel tables at Veterinary: (Owner Furnished and Installed)
 - 01 Size: 36" x 60" x 34" high to align with casework
 - 02 Type 304 Stainless Steel Construction
 - 03 4 leg unit with Center lower cross member capable of 1000 pound capacity

- E. Welders (6 Pack)
 - 01 Manufacturer: Miller 907406 or acceptable equal
 - 02 Six pack configuration with cart
 - 03 Provide all required leads and connections

- F. Welding Booths
 - 01 Manufacturer: WeldStation EVO, www.clean-air.com or acceptable equal
 - 02 Back to back configuration, or side by side configuration to meet layout indicated on Drawings .
 - 03 Blower: Backward incline, air foil high efficiency
 - 04 Direct drive, no belts or chains
 - 05 Three phase power ~3 Ph. : 208, 240, or 460 Volt, 6A - 19A
 - 06 5HP motor, 3,450 RPM
 - 07 Air volume 4,000 CFM
 - 08 Bronze Strip curtain Door
 - 09 Filter Cartridges: (4) Cellulose Flame Retardant Media
 - 10 Filter Media : 226 sq. ft/media each, totaling 904 sq. ft media
 - 11 Motor/Blower: 5 HP, Direct Drive, Backward Incline Blower
 - 12 Electrical Requirements: 3 Ph: 208, 240, or 460 Volt, 6A-19A
 - 13 Air Flow: 4,000 CFM (2,000 CFM Per Booth for Dual)
 - 14 Built-in Spark Arrestance: (2) 24"x24"x2" Metal Spark Bafflel, (2) 24"x24"x2" Metal Mesh
 - 15 Pulse Valve: (2) 1" Pulsing Valves, Pulse Controller for automatic or manual operation
 - 16 Compressed Air Requirements: 1" NPT compressed air connection; 70-90 PSI Required
 - 17 Silencing: Internal Noise Abatement in Motor/Blower Compartment, 60-74 DBA
 - 18 Internal Work Area: Now featuring 12" additional height available inside the work area with a 12" built-in riser
 - 19 Weight: 2,100 lbs (Standard Dual with no options)
 - 20 Dimensions of Booth: Standard 5': 124"H x 116"W x 41"D 3', 4', 6' secondary booths available;
 - 21 HMI Interface and remote access standard on all models (requires ethernet connection)

2.2 MATERIALS

- A. Provide necessary extension as required for each piece of equipment and transitions for dust collection system.
- B. Provide all fasteners, hookups and components necessary for a complete installation.
- C. Equipment list per attached schedule.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain dimensions affecting the work of this Section from the site.
- B. Obtain electrical and mechanical service characteristics and rough-in location from site.

3.2 INSTALLATION

- A. Assemble and install in accordance per manufacturer's printed instructions.
- B. Adjust for proper operation.
- C. Provide Owners orientation and demonstration of each piece of equipment.

END OF SECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56

SECTION 12 21 13

HORIZONTAL LOUVER BLINDS (Alternate 2)

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide horizontal blinds at all exterior windows.
 - 02 Provide at interior windows as indicated or scheduled on the Drawings.
- C. Related Work:
 - 01 Section 08 11 13 – Hollow Metal Doors and Frames
 - 02 Section 08 11 16 – Aluminum Door and Glazing Frames
 - 03 Section 08 80 00 – Glazing

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication and erection / installation of proposed assemblies.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.
- E. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Design of horizontal louver blinds is based on products manufactured by Levolor.

B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this section, provided all proposed products meet or exceed the specified requirements.

- 01 Bali Classics Custom Mini Blinds
- 02 Hunter

2.2 MATERIALS

A. Design of horizontal louver blinds is based on Levolor Riviera Contract 1" Blinds.

B. Horizontal blinds shall consist of the following:

- 01 Steel Channel Headrail: 'U'-shaped, 1" high x 1-1/2" deep, fabricated from .025 inch thick phosphate-treated steel with rolled edges at top, with a prime coat of vinyl primer and finish coat of polyester baked enamel to match bottom rail and slats.
- 02 Head Channel Hardware: Metal hardware shall be electroplated. Provide lift cords and braided ladders.
- 03 Enclosed Metal Bottom Rail: Tubular shape, .030 inch thick phosphate-treated steel with prime coat of vinyl primer and finish coat of polyester baked enamel matching headrail and slat color.
- 04 Slats: Slats shall be virgin aluminum alloyed for maximum strength, flexibility and resistance to internal and external corrosion.
 - a. Slats shall be nominal 1 inch wide.
 - b. Slats shall have a pre-coating treatment to bond the polyester baked enamel finished coating.
 - c. Total coating thickness shall be minimum 1.0 mil.
 - d. Color as selected by the Architect from manufacturer's full range of selections.
- 05 Tilter: Wand-type shall be operated by a length of transparent extruded plastic rod with a multi-sided cross-section measuring approximately 3/8 inch across points for comfortable grip.
 - e. Plastic wand shall be easily detachable by means of a wand link and sliding crystal sleeve.
 - f. Tilter shall be snap-fitted to headrail using no rivets or metal cleats.
- 06 Braided Ladders:
 - g. Distance between end ladder and end of slats shall not exceed 6 inches.
 - h. Distance between ladders shall not exceed 22 inches.
 - i. Material shall be polyester yarn. Vertical component shall be not less than .045 inch dia. nor greater than .066 inch diameter.
- 07 Cord lock and tilter operation locations: Tilter at left, cord lock at right (standard).
- 08 Installation brackets: End support, hinged cover brackets .042 inch thick treated steel with prime coat of epoxy primer and finish coat of polyester baked enamel in color to match headrail.
 - j. Brackets shall be marked left and right to facilitate installation and shall have a 1-1/4 inches extra-wide top to accommodate power screwdriver.
- 09 Intermediate support brackets: Brackets shall be furnished for blinds over 60 inches wide. Maximum spacing for intermediate support brackets shall be 48 inches.
- 10 Install valance brackets and double blade stacked slats at top of all blinds.

PART 3 - EXECUTION

3.1 FABRICATION

- A. Fabricate blinds to fit outside to outside of window frame, with length to extend full height down to sill / floor as applicable, unless indicated otherwise on the Drawings.
- B. For window blinds mounted at 9'-0" or above, provide extensions to control mechanisms.

3.2 INSTALLATION

- A. Install blinds at all exterior windows, and other locations scheduled or noted on the Drawings in accordance with manufacturer's installation procedures, except as otherwise specified herein.
- B. Install intermediate support brackets and extension brackets as needed to prevent deflection in headrail.
- C. Inside mount blinds with adequate clearance to permit smooth operation of blinds and any sash operators. Hold blinds 1/4 inch clear from each side of window opening unless other clearance is indicated.
- D. Set tilt and locking controls. Demonstrate blinds to be in smooth uniform working order.

3.1 CLEANING AND DEMONSTRATION

- A. Clean blinds in accordance with manufacturer's instructions.
- B. Demonstrate blinds to be in smooth uniform working order.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Plastic laminate clad casework.
 - 02 Plastic laminate clad countertops.
 - 03 Casework hardware and accessories.
 - 04 Plastic laminate window sills and other miscellaneous plastic laminate clad work as indicated on the Drawings.
- C. Related Work:
 - 01 Section 04 20 00 – Unit Masonry
 - 02 Section 06 10 00 – Rough Carpentry
 - 03 Section 09 21 16 – Gypsum Board Assemblies
 - 04 Division 22 – Plumbing
 - 05 Division 26 – Electrical

1.2 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Submit a copy of the Specification Section with any / all proposed deviations clearly marked and identified in red text / markings.
 - 01 For each item of non-compliance, indicate such and provide complete, detailed description of what is proposed in lieu of the specified item / requirement.
 - 02 Proposed alternatives for items of non-compliance may be accepted or rejected by the Architect; and in the case of rejection, the specified requirements shall be met.
- C. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- D. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- E. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
- 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details, including details of all joinery and assemblies.
 - 03 Show details of field fabrications, connections, and details.
 - 04 Provide full elevations of all proposed casework. Indicate dimensions, materials, and finishes. Indicate all locations to receive filler panels.
 - 05 Show locations of hardware, service fixtures, trim and other pertinent data for each unit.
 - 06 Indicate proposed laminate materials (type and thickness) for every surface of the cabinet unit (exposed, semi-exposed, interior, and concealed).
- F. Sample Cabinet:
- 01 Submit typical sample base cabinet (with base) representative of all proposed methods of construction, assembly, joinery, and finish.
 - 02 Sample must include a minimum of one drawer, one door, one interior shelf and removable countertop with attached backsplash.
 - 03 Sample cabinet does not need to have specific, selected plastic laminate finishes for this project.
 - 04 Once accepted, the sample cabinet shall be used as the basis to evaluate all casework provided for the project.
- G. Samples:
- 01 Submit plastic laminate samples (exposed surfaces and liners) of the full range of colors, patterns, textures and finishes from the manufacturer's standard colors, for Architect's selections.
 - 02 Submit full range of selections available for 3mm PVC edge banding and PVC flat edge banding.
 - 03 Submit samples of all hardware components proposed to be used.

1.3 DEFINITIONS

- A. Identification of casework components and related products by surface visibility.
- 01 Exposed Surfaces: Any unit exterior surface exposed after installation (door and drawer faces, face frames, exposed ends, unit tops below 72" AFF, and bottoms of upper cabinets above 60" AFF).
 - 02 Semi-Exposed Surfaces: Tops of units above 72" AFF, bottoms of upper cabinets below 60" AFF, unit interiors which are visible).
 - 03 Open Interior Surfaces: Any open unit without solid door or drawer front, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
 - 04 Closed Interior Surfaces: Any visible surface behind solid door or drawer fronts.
 - 05 Concealed Surfaces: Any surface not visible after installation (unit backs and ends when adjacent to another unit).

1.4 QUALITY ASSURANCE

- A. Manufacturer: Minimum of five (5) years of experience in providing manufactured casework systems for similar types of projects, and adequate facilities and personnel required to perform on this project in accordance with the specified requirements.

- B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.
- C. Single Source Manufacturer: Casework, countertops and other plastic laminate architectural products must all be engineered and built by a single source manufacturer to ensure consistency and quality for these related products.
- D. Quality Standard: Unless otherwise indicated or specified, comply with AWI's Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.

1.5 WARRANTY

- A. Furnish a written warranty that Work performed under this Section shall remain free from defects as to materials and workmanship for a period of three (3) years from date of acceptance. Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner.
- B. Defects include, but are not limited to:
 - 01 Ruptured, cracked, or stained coating.
 - 02 Discoloration or lack of finish integrity.
 - 03 Cracking or peeling of finish.
 - 04 De-lamination of components or edge-banding.
 - 05 Slippage, shift, or failure of attachment to wall, floor, or ceiling.
 - 06 Weld or structural failure (visible weld marks).
 - 07 Warping or unloaded deflection of components.
 - 08 Failure of hardware.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Design of educational casework is based on products as manufactured by TMI Systems Corporation / Texas Distributor: Specialty Supply & Installation Company.
- B. Acceptable Manufacturers: The following manufacturers are acceptable to provide products of this Section, provide all proposed products meet or exceed the specified requirements.
 - 01 Jericho Woodworks
 - 02 MGC, Inc.
 - 03 Phoenix Millwork
 - 04 Steven's Industries
- C. Casework of other recognized casework manufacturers may be considered for approval.
 - 01 Casework must conform to design, quality of materials, design intent, workmanship and exact performance function of casework components and details specified and implied by basis of design manufacturer's reference, and as shown on plans regardless of that manufacturer's "product standards".
 - 02 To be considered for acceptance, provide the following:
 - a. Company data and other information to support acceptance.
 - b. Evidence that company has been in the primary business of casework manufacturing for a minimum of five (5) years.

- c. Return a copy of this Specification with each item / paragraph initialed to signify compliance. Where deviation of any item is proposed, fully described the item proposed.
 - d. Provide a sample cabinet reflective of what is proposed to be furnished.
- D. Plastic Laminate: The following manufacturers are acceptable to provide plastic laminate:
 - 01 Formica
 - 02 Wilson Art
- E. Hardware: The following manufacturers are acceptable to provide casework hardware:
 - 01 Doug Mockett & Co.
 - 02 EPCO
 - 03 Julius Blum
 - 04 Knape & Vogt
 - 05 National
 - 06 Stanley

2.2 GENERAL

- A. Drawings and Specifications are based upon casework as manufactured by TMI Systems Design, fixed modular casework.
- B. Manufacturers requesting approval shall submit evidence of at least five (5) years of experience and installations for similar type of project. Manufacturers shall also provide catalogs and Specifications. Catalogs and Specifications shall be submitted with written request along with detailed list of compliance and deviations from these Documents for approval.
- C. In addition to the above requirements, manufacturers requesting approval shall, at the same time, submit certified product test data in accordance with ANSI A161.1-1980, NEMA LD3-2000, and general static load testing performed and certified by an independent testing agency, covering the following areas of product performance, with these minimum results:
 - 01 Base cabinet construction/racking test: 800 lbs.
 - 02 Cabinet front joint loading test: 425 lbs.
 - 03 Wall cabinet static load test: 2,000 lbs.
 - 04 Drawer front joint loading test: 600 lbs.
 - 05 Drawer construction/static load test: 750 lbs.
 - 06 Cabinet adjustable shelf support device/static load test: 300 lbs.
- D. The following performance details are project requirements and must be met by all bidders whether named herein, or approved by Addendum, regardless of that manufacturer's "Standards". Deviations will not be allowed.
 - 01 Minimum Quality Standard: comply with AWI's Architectural Woodwork Quality Standards section 400 - Custom Grade for grades of interior architectural casework, woodwork, construction, finishes and other requirements; except as modified by this specification.
 - 02 Cabinet Construction: All core materials shall be of an industrial grade, medium density particle board with non-formaldehyde binders. Board shall exceed performance requirements for ANSI A208.1-1999 M2 Standards.
 - 03 Structural Cabinet Body: Cabinet backs shall be inset from rear of body, and fully bound (dadoed) four sides. Provide 3/4 inch (19.1 mm) thick

- stiffeners fastened to back/body as specified herein. Back perimeter shall be toe-nailed with mechanical fasteners for tight interior fit and direct connection of back panel to body and sealed with full-perimeter high-strength hot-melt adhesive.
- 04 Interior Structure: All cabinets over 36 inches (914 mm) wide shall be furnished with a mechanically fastened, yet removable, vertical divider to reduce horizontal member/shelf deflection. Wall cabinets shall have a clear inside nominal depth of 12 inches (305 mm) unless detailed otherwise.
 - 05 Shelf Loading: Shelves shall meet the loading/deflection standards of the National Particleboard Association.
 - 06 Structural Drawer Body: Drawer body shall be doweled with 1/2 inch typical bottom, recessed, fully bound (dadoed) and joint-glued all four sides. Provide under body stiffeners as specified herein.
 - 07 Drawer Suspension: Drawer slides shall be self-closing design, with positive in-stop, out-stop, and out-keeper. Dynamic (operational) load rating shall be minimum 100 lbs. Minimum 150 lbs. static load rating.
 - 08 Structural Cabinet Support: Cabinet sub-base shall be of a separate and continuous ladder-type platform design, leveled and floor mounted prior to cabinet body placement. Material shall be exterior grade plywood. No cabinet sides-to-floor will be allowed.
- E. Architect / Owners opinion and decision shall be final in the evaluation of manufacturer's products for approval to bid or award of contract.

2.3 CORE MATERIALS

- A. High Performance Core Material:
- 01 All countertops, back splash and toe kicks will 7-Ply Birch plywood. All countertops near wet areas, such as sinks or dishwashers..., shall be marine grade 7-ply plywood.
 - 02 All other core materials shall be an Industrial Grade particle board, equal to Ultra-Stock-Premium which shall meet or exceed performance requirements for ANSI A208.1-1999 M2 Standards.
 - 03 All core materials shall be minimum 45 lb. density.
 - 04 All core materials shall have a minimum 250 lb. screw holding capacity on the face plane and minimum 225 lb. screw holding capacity on the edge plane.
- B. Cabinet components shall be of the following minimum core thicknesses:
- 01 Cabinet backs, drawer body, and drawer bottoms: 1/2" minimum.
 - 02 Door and drawer face, base, tops (excluding countertops) and bottoms, cabinet sides, drawer spreaders, cabinet back rear hang-strips, structural dividers, exposed cabinet backs, and shelves up to 36" wide: 3/4 inch minimum.
 - 03 Product-specific work surfaces, shelves over 36" wide and library stack shelving unless stack fitted with vertical divider: 1" minimum.
- C. Marine Grade Plywood:
- 01 APA Grade A-A, made entirely of Douglas-fir or Western Larch.
 - 02 All inner plies Grade B or better.
 - 03 All glues and adhesives shall be waterproof.
 - 04 Material shall comply with Voluntary Product Standard PS1-95 – Construction and Industrial Plywood.

2.4 LAMINATE MATERIALS

- A. All laminates shall meet or exceed NEMA LD3-2000 standards; including thicknesses for stated laminate types / grades.
- B. All lamination shall be performed with hybrid P.V.A. Type III water resistant adhesive.
- C. Lamination System – Exposed Vertical Applications: Doors, finished end panels, and other vertical, exposed laminate surfaces shall be laminated with:
 - 01 Minimum VGS – General Purpose grade laminate at .028" high-pressure plastic laminate. Color / pattern as selected by the Architect.
 - 02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at concealed locations shall be Contractor's option.
- D. Lamination System – Exposed Horizontal Applications: Countertops and backsplash exposed laminate surfaces shall be laminated with:
 - 01 Minimum HGP – Postforming grade laminate at .039" high-pressure plastic laminate. Color / pattern as selected by the Architect.
 - 02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at concealed locations shall be Contractor's option.
- E. Lamination System – Exposed Horizontal Applications: Cabinet tops (other than countertops) and bottoms, drawer and shelf components exposed laminate surfaces shall be laminated with:
 - 01 Minimum VGS – General Purpose grade laminate at .028" high-pressure plastic laminate. Color / pattern as selected by the Architect.
 - 02 Balancing sheet shall be same grade and thickness as finished face laminate. Color at cabinet interiors shall match cabinet liner color as selected by the Architect.
- F. Lamination System – Concealed Cabinet Backs and Ends: Concealed backs and ends of cabinet boxes that are finished with a 0.020" interior cabinet liner shall be minimum BKL – Unfinished Backing Sheet at 0.020".
- G. All lamination shall be performed with hybrid P.V.A. Type III water resistant adhesive.
- H. Laminate color selections:
 - 01 Standard laminate finishes from casework manufacturer's standard stock colors consisting of wood grain patterns, patterned colors and solid colors. Minimum of 200 selections available.
 - 02 Allow a total of five (5) different colors / patterns to be selected per project.
 - 03 Direction of wood grain shall be vertical on door, end panels, fascia panels, and exposed backs and ends; horizontal on drawer faces, aprons, and top rails.
 - 04 Exposed cabinet interiors not concealed by doors shall be a laminate as selected by the Architect.
 - 05 Unless otherwise noted, cabinet interiors concealed by doors shall be white.

2.5 EDGING MATERIALS

- A. Edging types. Provide one or more of the following in accordance with "Edging Locations":

- 01 3 mm thick PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, automatically trimmed, inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design.
 - 02 Flat Edge PVC: .020 inch (.51 mm). Solid, high-impact, purified, color-thru, acid resistant PVC edging, machine-applied with hot melt adhesives, automatically trimmed face, back and corners for uniform appearance. Manufacturer's option of .030 inch (.76 mm) high-pressure plastic laminate if matching PVC is unavailable.
- B. Edging Locations. Provide the above specified edging types at the following locations, of the following colors:
- 01 Door/Drawer-Front edging: 3mm PVC selected from a minimum of 30 standard colors, color matched to standard laminates.
 - 02 Cabinet body edge, including door/drawer front spacer rail: Flat Edge PVC, color matched to door / drawer face or as selected.
 - 03 Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat Edge PVC to match cabinet interior surface color.

2.6 DETAILED REQUIREMENTS FOR CABINET CONSTRUCTION:

- A. Base Cabinet Sub-Base:
- 01 All base cabinets shall be mounted on sleeper sub-base assemblies completely separate from the cabinet body.
 - 02 Vertical cabinet body components extending to the floor shall not be accepted.
 - 03 Cabinet sub-base shall be continuous and separate from base cabinets. Individual sub-bases attached to each base cabinet box shall not be accepted.
 - 04 Sub-base assemblies shall be fabricated from minimum 1-1/2" thick components, using one or more of the following materials / assemblies:
 - a. CCA / QCA treated 2x SYP materials.
 - b. CCA / QCA treated 1x SYP materials.
 - c. Marine grade plywood.
 - 05 Sub-base shall be ladder-type construction of individual front, back, ends and intermediates, to form a secure and level platform to which base cabinets attach.
 - a. The front of sub-base shall be a single continuous member wherever possible; and where not possible due to the length of the base cabinet bank, shall have joints at not less than 96" apart.
 - 06 Provide plastic shims as required to level the sub-base along its entire length.
 - 07 Sub-bases at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end, facilitating flush installation of finished base material by other trades.
- B. Cabinet Top and Bottom:
- 01 Solid sub-top shall be furnished for all base and tall cabinets.
 - 02 At cabinets over 36 inches, bottoms and tops shall be mechanically joined by a fixed divider.
 - 03 Exposed wall cabinet bottoms shall be Pressure Fused white laminate. Assembly devices shall be concealed on bottom side of wall cabinets.

- C. Cabinet Ends:
- 01 Exposed exterior cabinet ends shall be laminated with high-pressure plastic laminate, balanced with high-pressure cabinet-liner interior surface.
 - 02 Holes drilled for adjustable shelves shall be 1-1/4" on center to within 6" of top and bottom of cabinet.
- D. Cabinet Backs:
- 01 Cabinet back shall be fully bound (dadoed) into sides, top frame, and bottom, recessed 7/8 inch from cabinet rear.
 - 02 Back shall be secured to cabinet body with mechanical fasteners and solidified with a continuous bead of industrial grade hot melt adhesive.
 - 03 Hang rails shall be located at rear of cabinet back and fastened to cabinet sides.
 - a. Provide minimum of 2 at base cabinets, 2 at upper wall-hung cabinets, and 3 at tall cabinets.
 - 04 Exposed exterior backs shall be high-pressure plastic laminate balanced with high-pressure cabinet-liner.
- E. Door and Drawer Fronts:
- 01 Drawer fronts and hinged doors shall overlay the cabinet body.
 - a. Maintain a maximum 1/8 inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
 - 02 Laminated door and drawer fronts shall be 13/16 inch thick to provide a flush / on-plane appearance.
 - 03 Stile and rail doors shall be 13/16 inch thick with full 1/4 inch plate glass.
 - a. To be hinged or sliding as indicated on the Drawings.
 - b. All exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
 - 04 Frameless sliding glass doors shall be 1/4 inch thick clear, laminated safety glass with ground and polished edges. See Paragraph 2.8 HARDWARE for frame and rollers.
- F. Drawers:
- 01 Drawer fronts shall be applied to separate drawer body component sub-front.
 - 02 Drawer sides shall be doweled and glued to receive front and back, machine squared and held under pressure through final set.
 - 03 Drawer bottom shall be fully bound (dadoed) into front, sides, and back. Routing, in drawer body for bottom, shall receive continuous glue.
 - 04 Reinforce drawer bottoms with 1/2 inch x 4 inch intermediate underbody stiffeners, mechanically fastened, run front to back.
 - a. Drawers less than 24" wide do not require stiffeners.
 - b. Provide one stiffener at drawers 24" to 35" wide.
 - c. Provide two stiffeners at drawers 36" to 48".
 - 05 Drawers to be used for flat paper storage shall be fitted with a 6" deep, full width hood at back of drawer.
- G. Fixed and Adjustable Shelves:
- 01 Thickness shall be 3/4" for units up to 36" wide.
 - 02 Thickness shall be 1" for units wider than 36".
- H. Vertical and Horizontal Dividers: One of the following as indicated on the Drawings or by cabinet number:

- 01 Natural hardboard 1/4" thick, smooth both faces. Secure in cabinet with molded plastic clips.
 - 02 Plastic laminate clad, 1/2" or 3/4" thick core material. Sub-dividers shall be secured in cabinet with molded plastic clips or dowels.
 - 03 Structural dividers in cabinets over 36" wide shall be secured in cabinet with mechanical euro fasteners.
- I. Door / Drawer Front Rail: Provide minimum 3/4" x 6" x full width cabinet body rails immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, close off reveal, and be locator for lock strikes.
- J. Countertops:
- 01 High-pressure plastic laminate bonded to core.
 - 02 All countertops, back splash and toe kick shall be 7 ply birch plywood.
 - 03 All countertops within 36" of a sink, shall be marine grade veneer plywood.
 - 04 Core thickness: 1-1/4". Underside shall be fully balanced with minimum 0.020" backing sheet.
 - 05 Furnish countertops with edge treatment, backsplash and design profile as shown on Drawings. countertops to get PVC edging.
 - 06 Provide tops in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout.
 - 07 Mobile cabinet tops shall be high-pressure plastic laminate on exterior and high-pressure cabinet-liner on underside. Edges shall be high-impact 3 mm PVC.

2.7 WORKMANSHIP

- A. All exposed exterior cabinet surfaces shall be thicknesses specified, high-pressure laminate, color as selected by the Architect.
- 01 Laminate surface / balancing liner to core under controlled conditions by approved and regulated laminating methods to assure a premium lamination.
 - 02 Natural-setting hybrid P.V.A. Type III water resistant adhesives that cure through chemical reaction, containing no health or environmentally hazardous ingredients, are required. Methods requiring heat are not allowed; "contact" methods of laminating are not allowed.
- B. Cabinet parts shall be accurately machined and bored for premium grade quality joinery construction utilizing automatic machinery to insure consistent sizing of modular components. End panels shall be doweled to receive bottom and top.
- C. Back panel shall be fully bound (dadoed) into, and recessed 7/8" from the back of cabinet sides, top, and bottom to insure rigidity and a fully closed cabinet. Cabinet back shall be mechanically fastened from rear of body for tight interior fit and sealed with full-perimeter high-strength hot-melt adhesive.
- D. Drawer bottom shall be fully bound (dadoed) and glued into and recessed 1/2" up from the bottom of sides, back, and sub-front. Sides of drawer shall be doweled to receive drawer back and sub-front.
- E. 3/4 inch thick hang rails shall be mechanically fastened to end panels of all wall, base, and tall cabinets for extra rigidity and to facilitate installation.
- F. All cases shall be square, plumb, and true.

- G. Case body and drawer workmanship and quality of construction shall be further evidenced by Independent Testing Laboratory results.
- H. Provide removable back panels and closure panels for access plumbing behind cabinet at all sink base cabinets, and where shown on Drawings. Not applicable at base cabinets where water supply and sanitary is directly routed into a CMU back up wall.
- I. ADA, Americans with Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on Architectural Plans as "ADA", or by General Note. Shall be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:
 - 01 Countertop height: With or without cabinet below, not to exceed a height of 34" A.F.F. (Above Finished Floor) at a surface depth of 24 inches.
 - 02 Knee Space Clearance: Provide a minimum of 29" A.F.F. at apron, and minimum 30" clear span width. Typical at sinks that are open below.
 - 03 At sinks open below, provide a 3/4" x full width, plastic laminate clad, removable panel in front of sink and plumbing piping. Panel shall be attached to the adjacent base cabinet, both sides.
 - 04 Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than 8", and lower toe frontal depth shall be no less than 11" at a point 9" A.F.F., and as further described in Volume 56, Section 4.19.
 - 05 12" deep shelving, adjustable or fixed: Not to exceed a range from 9" A.F.F. to 54" A.F.F.
 - 06 Wardrobe cabinets: Shall be furnished with rod & shelf adjustable to 48" A.F.F. at a maximum 21" shelf depth.

2.8 HARDWARE

- A. Hinges: Heavy duty, five-knuckle, 2-3/4" institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Design is based on Stanley Hardware No. 351490, class 1592 Interleaf Casework Hinge, or approved equal.
 - 01 Mill ground, hospital tip.
 - 02 Hinge shall be full wrap around type of .088" thick tempered steel.
 - 03 Each hinge shall adjustable in both vertical and lateral directions to assure positive door attachment and alignment.
 - 04 Provide one pair per doors up to 48-inch height; and one and one-half pair on doors over 48" in height.
 - 05 Hinge shall accommodate 13/16" thick laminated door and allow 270 degree swing.
 - 06 Finish shall be 26D satin chromium plated finish.
- B. Pulls: Wire design, solid brass, 4" x 1-5/16" projection. Design is based on EPCO MC402-4-BRC; or approved equal.
 - 01 Finish shall be 26D satin chromium plated finish.
- C. Locks: *To match Standard District Casework Locks*
 - 01 Pin tumbler, cam type locksets, allowing removal of key when lock is in unlocked position.
 - a. Design is based on CompX National M2-0219 series; or approved equal.
 - 02 Locks keyed alike and master keyed as directed by the Architect / Owner.
 - 03 Provide catches on non-active leafs on door pairs.

- 04 Finish shall be 26D satin chromium plated finish or dull chrome finish.
- 05 Provide cabinet locks on units as indicated on the Drawings. If not indicated on the Drawings, provide locks for 100% of the doors and drawers. Coordinate locations with Architect.
- D. Standard Drawer Slides:
 - 01 Standard Drawers: Full extension, telescopic, self-closing design, steel ball bearing operation with positive in-stop, out-stop. Design is based on Knappe & Vogt # 8417; or approved equal.
 - 02 Minimum 100 lb. dynamic load rating. Electro-zinc plated with lacquer top coat.
- E. File Drawer Slides:
 - 01 File Drawers: Full extension, 3-part progressive opening slide on precision steel ball bearings; minimum 100 lb. dynamic load rating; hold-in feature to prevent bounce-back; positive in / out stops. Design is based on Knappe & Vogt # 8500; or approved equal.
 - 02 Provide integral, body mounted molded steel rails for hanging file system for legal and letter file drawers. Cutting or machining of drawer body / face is not allowed.
 - 03 Provide electro-zinc plated with lacquer top coat.
- F. Catches: Catch shall provide opening resistance in compliance with the Americans with Disabilities Act.
 - 01 Non-Locking Doors: Provide top-mounted magnetic catch for base and wall cabinet doors. Provide two at each tall cabinet door. Design is based on EPCO no. 592; or approved equal.
 - 02 Locking Pair of Doors: Furnish an elbow catch on the door leaf not receiving a lock. One required on doors up to 48 inches tall and two required (top and bottom) on doors over 48 inches tall. Design is based on EPCO no. 1018; or approved equal.
- G. Adjustable Shelf Supports: Twin pin design with anti-tip-up shelf restraints for both 3/4" and 1" shelves.
 - 01 Design shall include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip.
 - 02 Load rating shall be minimum 300 lbs. each support without failure.
 - 03 Cabinet interior sides shall be flush, without shelf system permanent projection.
- H. Wardrobe Rod: Shall be 1-1/16" rod, supported by flanges both sides, chrome finish; or equal.
- I. Coat Hooks:
 - 01 Single prong coat hooks, ceiling mount. Satin finish.
 - 02 Double prong coat hooks, ceiling mount. Satin finish.
- J. Grommet:
 - 01 Design is based Doug Mockett & Co. Model "XG", 3" diameter, round grommet with flip top series; or approved equal.
 - 02 Provide one (1) grommet at each non-plumbing knee space with power and data below countertop.
- K. Fasteners:
 - 01 All fasteners shall be of such type and length to withstand a minimum pull-out force of 200 LBS.

- 02 All screw fasteners shall extend a minimum of 67% into the substrate it is being used on.
- 03 Screw fasteners shall be countersunk type at all hardware fabricated to accept countersunk screws.
- 04 All screw fasteners shall be cadmium plated or stainless steel.
- 05 All screws seated directly against a cabinet panel shall be provided with appropriately sized washers.

2.9 SPECIAL MATERIALS

- A. Glass:
 - 01 Glass for framed and unframed doors shall be 1/4" thick clear laminated safety glass, complying with ASTM C1172, Kind LT, Condition A, Type 1, Class 1.
 - 02 Glass used in fume hood sashes or other equipment used in hazardous areas shall be 1/4" thick laminated safety type glass, complying with ASTM C1172, Kind LT, Condition A, Type 1, Class 1.
 - 03 Fluorescent light shielding in fume hoods shall be tempered glass offering greater resistance to heat and impact.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Carefully inspect all casework upon delivery. All units damaged upon arrival shall be returned to the manufacturer for repair and / or replacement.
- B. Any / all units which do not have required balance sheets on concealed surfaces shall be returned to the manufacturer for repair and / or replacement. Field application of balance sheets shall not be allowed.
- C. Leave protective shipping materials in place until casework is delivered to its final room destination. Use all means necessary to protect adjacent work during transit and installation in the building.

3.2 PREPARATION

- A. Coordinate with other trades as required for proper installation of blocking in walls, etc. for secure attachment of casework. Verify exact field installed locations.
- B. Inspect the installed work of other trades and verify that such work is complete to the point where this installation may properly commence. Closely inspect the squareness and flatness of walls behind cabinets to facilitate a tight, even fit of casework to wall. Coordinate with other trades as required for corrective prep work.
- C. Inspect conditions at floor slabs for proper installation of cabinet sub-bases. Coordinate with other trades as required for corrective prep work.
- D. Verify rough plumbing and electrical work is properly located to permit casework, fixtures and equipment to be installed in strict accordance with the original design, pertinent codes, and regulations, and reviewed Shop Drawings.

- E. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been resolved.

3.3 INSTALLATION

- A. Casework base cabinet components / boxes shall be assembled in the configurations and locations as indicated on the Drawings.
 - 01 Securely anchor base cabinets to sub-base and through back to wall blocking at top of casework.
 - 02 Securely fasten casework base cabinets through sides to adjacent base cabinet(s).
 - 03 In as much as practical, standardize fastener locations at each cabinet to maintain a uniform appearance.
- B. Casework upper wall cabinet components / boxes shall be assembled in the configurations and locations as indicated on the Drawings.
 - 01 Wall cabinets shall align with base cabinets unless specifically shown otherwise on the Drawings.
 - 02 Securely anchor upper wall cabinets through back to wall blocking at top and bottom of each cabinet.
 - 03 Securely fasten casework upper wall cabinets through sides to adjacent upper wall cabinet(s).
 - 04 In as much as practical, standardize fastener locations at each cabinet to maintain a uniform appearance.
- C. Provide matching fillers and scribes to fit cabinets to partitions, columns and other adjacent interfacing work. At wall-to-wall conditions, center cabinets for equal fillers / scribes each end.
- D. Provide closure panels at top and bottom of upper wall cabinets at blind corner and similar locations.
- E. Verify lengths of countertops, splashes, and sub-bases. Provide in longest practical lengths to minimize splices in plastic laminate. Securely fasten countertop to each base cabinet from the underside through the top of the base cabinet.
- F. Provide back-splashes and end-splashes wherever a back or end is adjacent to a wall, whether shown or not.
- G. Plumbing and electrical items shall be furnished under the Plumbing and Electrical Section.
 - 01 Installation of work furnished by the various trades shall be coordinated to assure properly functioning equipment at the completion of the job.
 - 02 The casework supplier shall be responsible for all cutouts necessary to receive plumbing items. Provide 'J' clamps to secure sinks to countertops.
- H. Seal all joints in countertops, splashes and walls continuous with clear acrylic sealant.

3.4 ADJUSTMENT

- A. Doors:
 - 01 Upon completion, adjust all doors / hinges to be hung plumb and square, resulting in a consistent gap between pairs of doors at +/- 1/8".
 - 02 Verify that magnetic catches and latches are positioned correctly to hold door in tight, fixed position. Adjust as required.
- B. Drawers:
 - 01 Upon completion, adjust all drawers to function easily and smoothly, without binding or shimmying.
 - 02 Verify that drawers with automatic closing hardware function properly.
- C. Locks:
 - 01 Verify all proposed locations with Architect prior to commencement.
 - 02 Verify locks in each room / area are keyed in accordance with the Owner's standards and direction.
 - 03 Install locks in cabinets as indicated on the Drawings or directed by the Architect.
 - 04 Provide stops, catches and similar hardware, properly placed to provide positive locking.
 - 05 Using cabinet body and similar components as stops / catches is prohibited.
- D. Final Cleaning: Upon completion of all final adjustments, thoroughly clean all debris from cabinets; including, but not limited to: glue, sealant, pencil marks, saw-dust, wood shavings, loose hardware, smudges, dirt and other similar items.

END OF SECTION

SECTION 13 34 19.13

WALL PANELS FOR PRE-ENGINEERED BUILDING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Work under this Section of the Specification shall include all labor, materials, equipment and appurtenances for the installation of Pre-engineered building wall panels as indicated on the Drawings and herein specified. To include all components and parts of the building (consisting of necessary bracing, struts and connecting members), wall panels, flashing curbs, gutters and downspouts, all with necessary closures and fasteners.
- C. Cooperation by Contractor for work of this Section of the Specifications with all other trades is mandatory, so that all phases of Work may be properly coordinated without delays or damage to any parts of any Work.
- D. The Contractor shall provide all items, articles, materials, operation, or methods listed, mentioned or scheduled on the Drawings and/or herein, including all labor, material, equipment and incidentals necessary and required for their completion.

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. The manufacturer shall furnish complete Drawings showing flashing details, and necessary installation details to clearly indicate the proper assembly of all building wall panels.

PART 2 - PRODUCTS

2.1 PRE-ENGINEERED BUILDING MANUFACTURERS

- A. The following manufacturers are acceptable:
 - 01 American Steel Building
 - 02 Butler Manufacturing Company
 - 03 Kirby Industries
 - 04 Metallic Building Company
 - 05 Mid-West Building Company
 - 06 Stran Steel Corporation

- B. Any other Pre-engineered building manufacturer desiring to turn in proposals for this project shall have approval in writing seven (7) days prior to proposal date.

PART 3 - EXECUTION

3.1 WALL PANELS

- A. General: Typical wall panels shall be 26-gauge galvanized steel cold-formed panels.
- B. Panel Materials: Material for galvanized steel panels shall conform to ASTM Specification for 50,000 PSI Yield Class C90.
- C. SH Panels- to be used for wall panels or match existing profiles at each site to be field verified.
- D. Fasteners:
- 01 All self-tapping sheet metal screws shall conform to A.S.A. Standard B 18.6 and shall have Type "A" or Type "AB" threads. Where required for weather tightness, screws shall be equipped with metal and EPDM washers.
 - 02 Optional self-drilling fasteners shall be No. 12-1 Type B self-drilling screw with non-walking point and two step thread to insure maximum strip-out torque in panel to panel usage.
 - 03 After plating, all exposed fasteners and washers shall be coated with one prime coat and two finish coats of baked silicone polyester. The color of the finish shall match the wall and/or roof panels.
 - 04 Screws and washers shall be carbon steel plated with .003" thick zinc or cadmium.
- E. Sealer:
- 01 Sealer for sidelaps, endlaps and flashing shall be asbestos fiber-filled, pressure sensitive tape. The sealer shall be non-asphaltic, non-shrinking, non-drying, and non-toxic and shall have superior adhesion to metals, plastics, and painted surfaces at temperatures from 30°F to -160°F. The material shall have a flashpoint of at least 300°F, and shall not flow at 200°F, equal in performance to Gov. Spec. No. MIL-C-18969, Type II, Class B.
 - a. 1/2" wide x 3/32" thick
- F. Wall Panel Installation:
- 01 Wall panels shall be secured to girts with sheer metal screws at a maximum spacing of 12".
 - 02 At the endlaps of SH panels the maximum spacing shall be 6".
 - 03 At the endlaps of panels the fasteners shall be attached to each side of the major rib.

- G. Flashing, Closures and Trim:
- 01 Flashing and/or trim shall be furnished at the rake, corners, and eaves; at reamed openings, and whenever necessary to provide weather tightness and a finished appearance.
 - 02 Galvanized steel for flashing, metal closures, trim and other miscellaneous uses shall conform to ASTM Specification A-361, Class G90.
 - 03 A formed panel matching the slope and profile of adjoining panels shall be provided along the building ridge.
 - 04 Solid or closed cell, performed Ethylene-Propylene Diene-Monomer (EPDM) or Ethylene Propylene Teroploymer (EPT) color gray, matching the profile of the panel shall be installed along the rake and/or eave where required for weather tightness.
- H. Color Finish:
- 01 All wall and roof panels, flashing, trim and other exposed galvanized steel surfaces shall be color coated. Color of wall panels and corner trim shall be selected by the Architect from the standard Metallic colors.
 - 02 The Color-cot system shall be "Metallic 262" silicone-polyester exterior coating, nominally 0.8 mils thick with a 0.2 mil thick primer for added adhesion and corrosion resistance. Interior coating shall be an 0.4 mil high quality interior coating with 0.1 mil primer, for a total nominal thickness of 0.5 mils.
- I. Louvers:
- 01 Louvers shall be furnished from 18-gauge galvanized steel and shall have blades of the overlapping type providing maximum weather tightness while allowing free air flow. Louvers shall be:
 - a. Fixed type with blades in fixed position.
 - b. Operable type.
- J. Eave Gutters and Downspouts:
- 01 Eave gutters shall be 26-gauge galvanized steel. Snap-on gutter straps shall be provided for ease in erection at a maximum spacing of 5'. Design of the gutter will permit rapid installation or removal after roof and wall sheets are in place. Gutter shall screen from view the eave ends of roof sheets. No portion of the gutter will protrude under the roof panels.
 - 02 Downspouts shall be 26-gauge galvanized steel rectangular shaped. Downspouts shall connect with boots and shall be supported by attachment to the wall covering at 10' maximum spacing.

END OF SECTION

SECTION 21 01 00

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each
 - 4) Local source of supply for parts and replacement
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed
 - 2) Identify data applicable to installation
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 - 4. Written text, as required to supplement product data for the particular installation:

- a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts
 - 1) Function, normal operating characteristics, and limiting conditions
 - 2) Performance curves, engineering data and tests
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Each Contractor's coordination drawings.
 - k. As installed color coded piping diagrams.
 - l. Charts of valve tag number, with location and function of each valve.
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - n. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 21.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide backflow preventer certified test reports.

END OF SECTION

SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Texas Department of Licensing & Regulations (TDLR)
 - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

FIRE PROTECTION GENERAL PROVISIONS

- 1 A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of
2 various elements of work. Determine exact locations from field measurements.

3
4 1.6 PROJECT RECORD DOCUMENTS

- 5
6 A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract
7 drawings for the sole purpose of recording the "as-built" changes and diagrams of those
8 portions of work in which actual construction is at variance with the contract drawings. Mark
9 the drawings with a colored pencil. Prepare, as the work progresses and upon completion of
10 work, reproducible drawings clearly indicating locations of various lines, valves, ductwork,
11 traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer
12 lines. Record existing and new underground and under slab piping with dimensioned locations
13 and elevations of such piping.

- 14
15 B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original
16 drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings,
17 obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were
18 necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the
19 Architect/Engineer's records). Delivery of these as-built prints and reproducible is a
20 condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex
21 mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

- 22
23 C. As-Built drawings should indicate the following information as a minimum:
24 1. Indicate all addendum changes to documents.
25 2. Remove Engineer's seal, name, address and logo from drawings.
26 3. Mark documents RECORD DRAWINGS.
27 4. Clearly indicate: DOCUMENT PRODUCED BY
28 5. Indicate all changes to construction during construction. Indicate actual routing of all
29 piping, etc. that were deviated from construction drawings.
30 6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
31 7. During the execution of work, maintain a complete set of drawings and
32 specifications upon which all locations of equipment, ductwork, piping, devices, and
33 all deviations and changes from the construction documents in the work shall be
34 recorded.
35 8. Location and size of all ductwork and mechanical piping above ceiling including
36 exact location of isolation of domestic and plumbing valves.
37 9. Exact location of all electrical equipment in and outside of the building.
38 10. Fire Protection System documents revised to indicate exact location of all sprinkler
39 heads and zone valves.
40 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
41 12. Cloud all changes.

42
43 1.7 SPACE REQUIREMENTS

- 44
45 A. Consider space limitations imposed by contiguous work in selection and location of
46 equipment and material. Do not provide equipment or material that is not suitable in this
47 respect.

48
49 1.8 RELATION WITH OTHER TRADES

- 50
51 A. Carefully study all matters and conditions concerning the project. Submit notification of
52 conflict in ample time to prevent unwarranted changes in any work. Review other Divisions
53 of these specifications to determine their requirements.
54
55 B. Because of the complicated relationship of this work to the total project, conscientiously study
56 the relation and cooperate as necessary to accomplish the full intent of the documents.

- 1
2 C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends
3 of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and
4 locate bolts and fittings required to be cast in them.
5
6 D. Locate and size openings required for installation of work specified in this Division in
7 sufficient time to prevent delay in the work.
8
9 E. Refer to other Divisions of the specifications for the scope of required connections to
10 equipment furnished under that Division. Determine from the Contractor for the various
11 trades, the Owner, and by direction from the Architect/Engineer, the exact location of all
12 items.
13
14 1.9 CONCEALED AND EXPOSED WORK
15
16 A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and
17 the like, the work is understood to mean hidden from sight as in chases, furred spaces or
18 above ceilings. "Exposed" is understood to mean open to view.
19
20 1.10 GUARANTEE
21
22 A. Guarantee work for 1 year from the date of substantial completion of the project. During that
23 period make good any faults or imperfections that may arise due to defects or omissions in
24 material, equipment or workmanship. At the Owner's option, replacement of failed parts or
25 equipment shall be provided.
26
27 1.11 MATERIAL AND EQUIPMENT
28
29 A. Furnish new and unused materials and equipment meeting the requirements of the paragraph
30 specifying acceptable manufacturers. Where two or more units of the same type or class of
31 equipment are required, provide units of a single manufacturer.
32
33 1.12 NOISE AND VIBRATION
34
35 A. Select equipment to operate with minimum noise and vibration. If objectionable noise or
36 vibration is produced or transmitted to or through the building structure by equipment, piping,
37 ducts or other parts of work, rectify such conditions at no additional cost. If the item of
38 equipment is judged to produce objectionable noise or vibration, demonstrate at no additional
39 cost that equipment performs within designated limits on a vibration chart.
40
41 1.13 ACCEPTABLE MANUFACTURERS
42
43 A. Manufacturers names and catalog number specified under sections of Division 21 are used to
44 establish standards of design, performance, quality and serviceability and not to limit
45 competition. Equipment of similar design, equal to that specified, manufactured by a named
46 manufacturer will be acceptable on approval. A request for prior approval of equipment not
47 listed must be submitted ten (10) days before bid due date. Submit complete design and
48 performance data to the Engineer.
49
50 1.14 OPERATING TESTS
51
52 A. After all plumbing systems have been completed and put into operation, subject each system
53 to an operating test under design conditions to ensure proper sequencing and operation
54 throughout the range of operation. Tests shall be made in the presence of the
55 Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems.
56 Special tests on individual systems are specified under individual sections. Submit 3 copies of

all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.

1. Provide the training during the Owner's regular working day.
 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
1. Minimum of 4 hours dedicated instructor time.
 2. 2 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
1. One copy to the Owner.
 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
1. Designation approved by Architect/Engineer.
 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's

1 representative, utility companies, municipalities, and other interested parties that all
2 available information has been provided.

- 3 2. Should obstruction be encountered, whether shown or not, alter routing of new work,
4 reroute existing lines, remove obstruction where permitted, or otherwise perform
5 whatever work is necessary to satisfy the purpose of the new work and leave existing
6 services and structures in a satisfactory and serviceable condition.

- 7
8 B. Assume total responsibility for and repair any damage to existing utilities or construction,
9 whether or not such existing facilities are shown.

10
11 3.7 PROTECTION

- 12
13 A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean
14 and in original manufacturer's condition.

15
16 END OF SECTION

SECTION 21 05 10

FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1 PART 2 - PRODUCTS

2
3 2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

4
5 PART 3 - EXECUTION

6
7 3.1 PROTECTION OF EQUIPMENT

8
9 A. Do not deliver equipment to the project site until progress of construction has reached the
10 stage where equipment is actually needed or until building is closed in enough to protect the
11 equipment from weather. Equipment allowed to stand in the weather will be rejected, and the
12 Contractor is obligated to furnish new equipment of a like kind at no additional cost to the
13 Owner.

14
15 B. Adequately protect equipment from damage after delivery to the project. Cover with heavy
16 tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint,
17 mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause
18 corrosion.

19
20 END OF SECTION

SECTION 21 05 12

FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}" = 1'-0"$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings

- 1 F. Contractor's responsibility for errors and omissions in submittals is not relieved whether
2 Architect / Engineer reviews submittals or not.
3
- 4 G. Contractor's responsibility for deviations in submittals from requirements of Contract
5 Documents is not relieved whether Architect / Engineer reviews submittals or not, unless
6 Architect / Engineer gives written acceptance of the specific deviations on reviewed
7 documents.
8
- 9 H. Submittals shall show sufficient data to indicate complete compliance with Contract
10 Documents:
11 1. Proper sizes and capacities
12 2. That the item will fit in the available space in a manner that will allow proper service
13 3. Construction methods, materials and finishes
14
- 15 I. Schedule submissions at least 15 days before date reviewed submittals will be needed.
16
- 17 1.7 SUBMISSION REQUIREMENTS
18
- 19 A. Make submittals promptly in accordance with approved schedule, and in such sequence as to
20 cause no delay in the Project or in the work of any other Contractor.
21
- 22 B. Number of submittals required:
23 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency
24 and three opaque reproductions.
25 2. Product Data: Submit the number of copies which the contractor requires, plus those
26 which will be retained by the Architect / Engineer.
27
- 28 C. Accompany submittals with transmittal letter, in duplicate, containing:
29 1. Date
30 2. Project title and number
31 3. Contractor's name and address
32 4. The number of each Shop Drawing, Project Datum and Sample submitted
33 5. Other pertinent data
34
- 35 D. Submittals shall include:
36 1. The date of submission
37 2. The project title and number
38 3. Contract Identification
39 4. The names of:
40 a. Contractor
41 b. Subcontractor
42 c. Supplier
43 d. Manufacturer
44 5. Identification of the product
45 6. Field dimensions, clearly identified as such
46 7. Relation to adjacent or critical features of the work or materials
47 8. Applicable standards, such as ASTM or federal specifications numbers
48 9. Identification of deviations from contract documents
49 10. Suitable blank space for General Contractor and Architect / Engineer stamps
50 11. Contractor's signed and dated Stamp of Approval
51
- 52 E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
53 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
54 2. Associated items which require correlation for efficient function or for installation
55
- 56 1.8 SUBMITTAL SPECIFICATION INFORMATION

- 1
2 A. Every submittal document shall bear the following information as used in the project manual:
3 1. The related specification section number
4 2. The exact specification section title
5
6 B. Submittals delivered to the Architect / Engineer without the specified information will not be
7 processed. The Contractor shall bear the risk of all delays, as if no submittal had been
8 delivered.
9

10 1.9 RESUBMISSION REQUIREMENTS

- 11
12 A. Make re-submittals under procedures specified for initial submittals.
13 1. Indicate that the document or sample is a re-submittal
14 2. Identify changes made since previous submittals
15
16 B. Indicate any changes which have been made, other than those requested by the Architect /
17 Engineer.
18

19 1.10 CONTRACTOR'S STAMP OF APPROVAL

- 20
21 A. Contractor shall stamp and sign each document certifying to the review of products, field
22 measurements and field construction criteria, and coordination of the information within the
23 submittal with requirements of the work and of Contract Documents.
24
25 B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner
26 and Architect / Engineer that Contractor has either determined and verified all quantities,
27 dimensions, field construction criteria, materials, catalog numbers, and similar data or
28 assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each
29 submittal with the requirements of the work and the Contract Documents.
30
31 C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's
32 stamp of approval and signature.
33
34 D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and
35 signature will not be processed. The Contractor shall bear the risk of all delays, as if no
36 submittal had been delivered.
37

38 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- 39
40 A. The Architect / Engineer will:
41 1. Review identified submittals with reasonable promptness and in accordance with
42 schedule
43 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or
44 approval of submittal
45 3. Return submittals to Contractor for distribution or for resubmission
46
47 B. Review and approval of submittals will not extend to design data reflected in submittals
48 which is peculiarly within the special expertise of the Contractor or any party dealing directly
49 with the Contractor.
50
51 C. Architect / Engineer's review and approval is only for conformance with the design concept of
52 the project and for compliance with the information given in the contract.
53 1. The review shall not extend to means, methods, sequences, techniques or procedures
54 of construction or to safety precautions or programs incident thereto.
55 2. The review shall not extend to review of quantities, dimensions, weights or gauges,
56 fabrication processes or coordination with the work of other trades.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 21 05 13

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for fire protection equipment.
 - 2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
 - 5. Pipe heat tracing.
- C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.
- F. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.
- G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

- 1
2 A. Provide motors for fire protection equipment manufactured by one of the following:
3 1. Baldor Electric Company.
4 2. Century Electric Div., Inc.
5 3. General Electric Co.
6 4. Louis Allis Div.; Litton Industrial Products, Inc.
7 5. Lincoln Electric
8 6. Marathon Electric Mfg. Corp.
9 7. Reliance Electric Co.
10 8. Westinghouse Electric Corp.
11
12 B. Motor Characteristics. Except where more stringent requirements are indicated, and except
13 where required items of fire protection equipment cannot be obtained with fully complying
14 motors, comply with the following requirements for motors of fire protection work:
15
16 C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for
17 continuous duty at full load (Class A Insulation).
18
19 D. Provide each motor capable of making starts as frequently as indicated by automatic control
20 system, and not less than 5 starts per hour for manually controlled motors.
21
22 E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for
23 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller,
24 except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type.
25 Coordinate current characteristics with power specified in Division 26 sections, and with
26 individual equipment requirements specified in other Division 21 requirements. For 2-speed
27 motors provide 2 separate windings on polyphase motors. Do not purchase motors until power
28 characteristics available at locations of motors have been confirmed, and until rotation
29 directions have been confirmed.
30
31 F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
32
33 G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C"
34 where required for high starting torque.
35 1. Frames. NEMA #56.
36 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable
37 except permanently sealed where motor is inaccessible for regular maintenance.
38 Where belt drives and other drives produce lateral or axial thrust in motor, provide
39 bearings designed to resist thrust loading. Refer to individual section of Division 21
40 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
41 3. Except as indicated, provide open drip-proof motors for indoor use where
42 satisfactorily housed or remotely located during operation, and provide guarded drip-
43 proof motors where exposed to contact by employees or building occupants. Provide
44 weather-protected Type I for outdoor use, Type II where not housed. Refer to
45 individual sections of Division 21 for other enclosure requirements.
46 4. Provide built-in thermal overload protection and, where indicated, provide internal
47 sensing device suitable for signaling and stopping motor at starter.
48 5. Noise Rating: Provide "Quiet" rating on motors.
49
50 H. All motors shall be premium efficiency.

51
52 2.2 EQUIPMENT FABRICATION
53

- 54 A. Fabricate fire protection equipment for secure mounting of motors and other electrical items
55 included in work. Provide either permanent alignment of motors with equipment, or
56 adjustable mountings as applicable for belt drives, gear drives, special couplings and similar

indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 21 05 14

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

- 1 C. Verify field measurements, above and underground piping connections and flows.
- 2
- 3 D. Demolition Drawings are based on casual field observation, and when available, existing
- 4 record documents. Report discrepancies to Architect before disturbing existing
- 5 installation, and immediately after such discrepancies are discovered.
- 6
- 7 E. Field verify existing conditions and actual utility uses prior to final connections. Existing
- 8 drawings may not have been available for all required information.
- 9
- 10 3.2 APPLICATION
- 11
- 12 A. Existing materials and equipment indicated on the drawings or in the specifications to be
- 13 reused shall be cleaned and reconditioned, including cleaning of piping systems prior to
- 14 installation and reuse, or abandon.
- 15
- 16 B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse
- 17 on the project shall become the property of the Contractor and be removed from the site.
- 18
- 19 C. Material or equipment salvaged for Owner's use shall be carefully handled and stored
- 20 where directed by the Owner or the Architect / Engineer. Relocate material and / or
- 21 equipment as directed by Owner.
- 22
- 23 D. Materials and equipment not indicated to be removed or abandoned shall be reconnected
- 24 to the new system.
- 25
- 26 E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be
- 27 removed for Owner's review and salvaged by Contractor.
- 28
- 29 F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to
- 30 identify and document items to be salvaged for Owner's use.
- 31
- 32 G. Clean and repair existing materials and equipment that remain or are to be reused.
- 33
- 34 H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations,
- 35 for maintenance, and for repairs.
- 36
- 37 3.3 SEQUENCE AND SCHEDULE
- 38
- 39 A. Coordinate utility service outages with Utility Company, Architect and Owner.
- 40
- 41 B. Provide additional or temporary valves, piping and connections to maintain existing
- 42 systems in service during construction.
- 43
- 44 C. Existing Fire Protection Service: Refer to drawings for work in remodeled areas. Where
- 45 facilities in these areas are to remain in service, any related work to keep the facilities in
- 46 operation is specified in this Division. Maintain existing system in service until new
- 47 system is complete and ready for service. Disable system only to make switchovers and
- 48 connections. Obtain permission from Owner at least 48 hours before partially or
- 49 completely disabling system. Minimize outage duration. Make temporary connections to
- 50 maintain service in areas adjacent to work area. Maintain acceptable temperature and
- 51 humidity control within existing building during renovation activities.
- 52
- 53 D. Remove and replace existing fire protection systems and appurtenances as occasioned by
- 54 new or remodeled construction. Re-establish service that may be interrupted by
- 55 remodeled construction.
- 56

- 1 E. Refer to other drawings series for work in remodeled areas. Where facilities in these
2 areas are required to remain in service, any related work required to keep these facilities
3 in operation is specified in this Division.
4
- 5 F. Remove and replace existing piping coincident with the construction.
6
- 7 3.4 DEMOLITION AND EXTENSION OF EXISTING FIRE PROTECTION WORK
8
- 9 A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated
10 on the drawings or required by the installation of new facilities. All removals and/or
11 dismantling shall be conducted in a manner as to produce maximum salvage. Salvage
12 materials shall remain the property of the Owner and shall be delivered to such
13 destination as directed by the Owner's representative unless they are not wanted, then it
14 will be the responsibility of this Contractor to remove such items and properly dispose of
15 them. Materials and/or items scheduled for relocation, and which are damaged during
16 dismantling or reassembly operations shall be repaired and restored to good operative
17 condition. The Contractor may, at his discretion, and upon approval of the Owner's
18 representative substitute new materials and/or items of like design and quality in lieu of
19 materials and/or items to be relocated.
20
- 21 B. All items to be relocated shall be carefully removed in reverse to original assembly or
22 placement and protected until relocated. The Contractor shall clean, repair, and provide
23 all new materials, fittings, and appurtenances required to complete the relocations and to
24 restore them to good operative order. All relocations shall be performed by workmen
25 skilled in the work and in accordance with standard practice of the trades involved.
26
- 27 C. When items scheduled for relocation and/or reuse are found to be in damaged condition
28 before work has been started on dismantling, the Contractor shall call the attention of the
29 Owner's representative to such items and receive further instructions before removal.
30 Items damaged in repositioning operations are the contractor's responsibility and shall be
31 repaired or replaced by the contractor as approved by the owner's representative, at no
32 additional cost to the Owner.
33
- 34 D. Fire protection piping and appurtenances to be removed, salvaged, or relocated shall be
35 removed to points indicated on the drawings, specified, or acceptable to the Owner's
36 representative. Piping not scheduled for reuse shall be removed to the points at which
37 reuse is to be continued or service is to remain. Such services shall be sealed, capped, or
38 otherwise tied-off or disconnected in a safe manner acceptable to the Construction
39 Inspector. All disconnections or connections into the existing facilities shall be done in
40 such a manner as to result in minimum interruption of services to adjacent occupied
41 areas. Services to existing areas or facilities that must remain in operation during the
42 construction period shall not be interrupted without prior specific approval of the
43 Owner's representative hereinbefore specified.
44
- 45 E. Repair adjacent construction and finishes damaged during demolition and extension
46 work.
47
- 48 F. Maintain access to mechanical installations that remain active. Modify installation or
49 provide access panel as appropriate.
50
- 51 G. Extend existing installations using materials and methods compatible with existing fire
52 protection installation, or as specified.
53
- 54 H. Existing fire protection piping, and devices found to need additional hangers installed
55 shall be added at no additional cost to the Owner.
56

- 1 3.5 PROTECTION OF THE WORK
2
3 A. Provide adequate temporary support and auxiliary structure as necessary to ensure
4 structural value or integrity of affected portion of work.
5
6 B. Provide devices and methods to protect other portions of work from damage.
7
8 C. Execute fitting and adjustment of products to provide a finished installation to comply
9 with specified products, functions, tolerances and finishes.
10
11 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS
12
13 A. Identification of Equipment: Provide new identification of all existing equipment to be
14 reused and located within the renovated areas. Do not include the description “existing”.
15 Provide new nameplates for all existing equipment in renovated areas as specified in
16 Section 21 05 00 Fire Protection General Provisions.
17
18 END OF SECTION

SECTION 21 10 00

FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs, and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.
- B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.
- C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.
- D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.
- E. Do not exceed 52,000 square feet of building for each individual sprinkler system.
- F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20
- G. It shall be the fire protection installer's responsibility to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure, and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.
- H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.
- I. Study the general, structural, electrical, and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

- J. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

- A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.
- B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

- A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state, and federal fire authorities.
- B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.
- C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.
- B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
- C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.
- D. Provide 1/4 scale drawings to show the location of the water entry into building with all zone valves, and shut-off valves, with alarms and drains at this location. Prepare the sprinkler drawings under the work of this Section.
- E. Submit samples of all sprinkler types for approval.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Johnson Controls (Tyco Fire Products)
1. Gem/Grinnell
 2. Central
 3. Star Sprinkler

- 1 B. Automatic Sprinkler Company of America
- 2
- 3 C. Potter Roemer, Inc.
- 4
- 5 D. The Reliable Automatic Sprinkler Company
- 6
- 7 E. Viking Corporation
- 8
- 9 F. Victaulic Company of America
- 10
- 11 G. Globe Fire Sprinkler Corporation
- 12
- 13 2.2 PIPING AND FITTINGS
- 14
- 15 A. Above Slab Inside Building
- 16 1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or
- 17 ASTM A135 joined with threaded fittings.
- 18 2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
- 19 a. Schedule. 40, black steel pipe joined with rolled grooved fittings.
- 20
- 21 B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to
- 22 ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according
- 23 to the pipe manufacturer's recommendations.
- 24
- 25 C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized
- 26 per ASTM A53.
- 27
- 28 D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance with
- 29 the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.
- 30
- 31 2.3 SPRINKLER HEAD
- 32
- 33 A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice
- 34 size.
- 35
- 36 B. All heads shall be UL listed and/or FM approved and comply with the latest requirements of
- 37 NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with "O" ring
- 38 design shall not be acceptable.
- 39
- 40 C. Exposed areas:
- 41 1. Standard upright type with brass finish and escutcheon. Provide temperature rating
- 42 per NFPA 13 and UL/FM approvals.
- 43 2. Tyco Model B, FRB, Globe Model GL-QR, GL-SR, or approved equal
- 44
- 45 D. Sidewall applications:
- 46 1. Horizontal sidewall type with brass finishes and chrome escutcheon.
- 47 2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature
- 48 rating per NFPA 13 and UL/FM approvals.
- 49 3. Tyco Model B, FRB, Globe Model GL-QR/SW, GL-SR/SW, or approved equal.
- 50
- 51 E. Suspended ceilings:
- 52 1. Adjustable drop-down deflector type concealed heads with manufacturer painted
- 53 white cover plate with glass bulb fusible link. Provide temperature rating per NFPA
- 54 13 and UL/FM approvals.
- 55 2. Color of plate, selected by Architect

3. Tyco Series RFII; Series ELOC, Globe Concealed Models GL-QR/INCH, GL-SW/INCH and GL-INCH/ECLH or approved equal.
- F. Dry sprinklers heads at freezers and coolers
1. Tyco Model DS-1, DS-2, or approved equal.
- G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and listed heavy duty bolt on guards. Bulb type sprinklers will not be acceptable for these locations.
1. Storage rooms with exposed structure.
 2. Gymnasiums.
 3. Mechanical and Electrical rooms.
 4. Below exposed stairs.
 5. Exposed structure areas.
- H. Systems serving walk-in freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer's recommendation with respect to freezer ambient temperatures expected.
- 2.4 INSPECTOR'S TEST CONNECTION
- A. Provide inspector's test connection as required by NFPA 13.
1. Ductile iron module housing with combination sight glass, orifice, and bonnet assembly
 2. UL listed
 3. Victaulic No. 718
 4. Globe Model UTD
 5. Tyco, or approved equal
- 2.5 TAMPER SWITCH / SUPERVISORY SWITCH
- A. Tamper switch on each valve
1. Controlling or shutting off sprinkler system or any portion thereof.
 2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
 3. Switch shall be compatible with installed valve for standard mounting.
 4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.
- 2.6 FLOW SWITCH
- A. Vane type flow switch.
1. Self-contained pneumatic, adjustable retard.
 2. Two, single pole, double throw switches.
 3. Red enamel tamper proof switch housing with flow paddle.
 4. Potter Roemer Model No. 6200 or approved equal.
- 2.7 FLOORS AND CEILING PLATES
- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.
- 2.8 DOMESTIC MANUFACTURE

1 A. All piping material, pipe and pipe fittings shall be manufactured in the United States of
2 America.

3
4 2.9 DRY PIPE SYSTEM

5
6 A. General: Provide a UL listed, and FM approved dry pipe system at the dock area. System
7 shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all
8 associated trim and piping for a complete operating system.

9
10 B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi,
11 supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup
12 assembly, manufactured by Victaulic Model 756, Globe Model RCW.

13
14 C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with
15 safety relief valve manufactured by Reliable Model A or approved equal. Size of air
16 compressor is determined by volume of dry pipe system. Coordinate power requirement with
17 electrical contractor. Coordinate all wiring required with Fire Alarm System.

18
19 D. If the dry pipe system is not used in conjunction with a wet pipe system containing the
20 necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe
21 system at the connection to the water supply.

22
23 E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control
24 valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y
25 shall be installed in the system.

26
27 F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.

28
29 G. Provide an automatic or manual compressed air system capable of restoring normal air
30 pressure to a system in 30 minutes or less.

31
32 H. Provide an accelerator when system capacity exceeds 500 gallons.

33
34 I. Provide a water motor alarm or electric pressure switch.

35
36 J. Provide dry pipe valve trim and pressure gauges.

37
38 K. Dry pipe system shall be hydraulically calculated for the hazard being protected.

39
40 L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a
41 heated area.

42
43 M. Provide a test drain valve sized per NFPA. An inspector's test shall be provided at each
44 system.

45
46 N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.

47
48 O. The following accessories shall be provided where required:

- 49 1. Victaulic Series 756.
50 2. Viking Model E dry pipe valve with conventional trim.
51 3. Viking Model D-1 accelerators.
52 4. Globe Model RCW dry pipe valve with conventional trim package, and Model C
53 Accelerator.

54
55 2.10 GASKETS

56

- 1 A. Use 1/16-inch-thick preformed synthetic rubber bonded.
- 2
- 3 2.11 COUPLINGS
- 4
- 5 A. Use listed rolled grooved mechanical couplings to engage and lock grooved, or shouldered
- 6 pipe ends and to allow for some angular deflection, contraction, and expansion. Coupling
- 7 consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket
- 8 Material for dry pipe systems shall be silicone and listed for dry pipe service.
- 9
- 10 2.12 VALVES
- 11
- 12 A. Use valves suitable for 175 psig WOG.
- 13
- 14 B. Valves to be UL listed and FM approved.
- 15
- 16 C. Valve Connections:
- 17 1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use
- 18 full line size valves unless noted otherwise.
- 19 2. Screwed ends for pipe sizes 2 inches and smaller.
- 20 3. Flanged ends for pipe sizes 2-1/2 inches and larger.
- 21 4. Solder or screw to solder adapters for copper tubing.
- 22 5. Use grooved body valves with mechanical grooved jointed piping.
- 23
- 24 D. Gate Valves:
- 25 1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed
- 26 ends, manufactured by: Mueller, or approved equal.
- 27 2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid
- 28 wedge, flanged ends; manufactured by Mueller, or approved equal.
- 29
- 30 E. Check Valves:
- 31 1. Up to 2-inch, bronze, regrind bronze swing disk, solder, or screwed ends; 200 WOG,
- 32 manufactured by Mueller, or approved equal.
- 33 2. Over 2-inch, iron body bronze trim, swing disk, regrind – renew bronze disk and
- 34 seat, flanged ends; 200 WOG, manufactured by Mueller, Globe Model RCV, or
- 35 approved equal.
- 36
- 37 F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze
- 38 disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved
- 39 equal.
- 40
- 41 G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building
- 42 where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and
- 43 indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator
- 44 flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron
- 45 body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to
- 46 main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post
- 47 No. A20800, or approved equal.
- 48
- 49 H. Wall post-adjustable indicating valve: Outside building at water entry location into building,
- 50 consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body,
- 51 non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end.
- 52 Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment
- 53 span with handle and tamper switch wired to main fire alarm control panel, manufactured by
- 54 Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.
- 55
- 56 2.13 ELECTRIC ALARM BELL

- 1
- 2 A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell,
- 3 UL listed, red enamel steel, manufactured by Simplex, or approved equal.
- 4
- 5 2.14 GAUGES
- 6
- 7 A. Gauges shall be bourdon tube type with minimum 4-1/2-inch dial and die cast aluminum case
- 8 with screwed ring and black enamel finish. The movement shall be all stainless steel with
- 9 Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge
- 10 shall be within one-half of one percent of the scale range. The pointer shall be the micrometer
- 11 adjustment type recalibrated from the front. Pressure and compound gauges shall have
- 12 suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.
- 13
- 14 B. Gauges shall have 1/4 inch connections and be mounted with combination stop / snubber
- 15 needle valve with suitable pressure rating. Scale ranges: 0-200 psi.
- 16
- 17 C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75
- 18 percent of the full-scale range.
- 19
- 20 D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments,
- 21 with minor divisions in 2 psig increments.
- 22
- 23 E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made
- 24 in accordance with ASME B40.1 accuracy grade 2A.
- 25
- 26 F. Manufactured by:
- 27 1. Terice Model No. 4500 Series
- 28 2. Ashcroft
- 29 3. Marsh
- 30 4. Weksler
- 31
- 32 2.15 SPARE SPRINKLER HEAD BOX
- 33
- 34 A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used)
- 35 for emergency replacement. Provide sprinkler wrench.
- 36
- 37 2.16 ALARM CHECK VALVE
- 38
- 39 A. Provide UL listed check valve.
- 40 1. Variable for City Supplied systems pressure trim set.
- 41 2. Constant for Fire Pump Systems pressure trim set.
- 42 3. Tyco AV-1, Globe Model H, or approved equal.
- 43
- 44 2.17 WATER MOTOR ALARM
- 45
- 46 A. Provide a red enamel motor alarm for installation on exterior wall.
- 47 1. Tyco Model WMA-1, Globe Model WM, or approved equal.
- 48
- 49 2.18 SIAMESE FIRE DEPARTMENT CONNECTION
- 50
- 51 A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate
- 52 lettered AUTO-SPKR.
- 53 1. Provide a 4" X 2-1/2" x2-1/2".
- 54 2. Potter-Roemer #5751
- 55

56 PART 3 - EXECUTION

1
2 3.1 DESIGN
3

- 4 A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of
5 NFPA 13 for the indicated occupancy.
6
7 B. Uniform discharge density design shall be based on hydraulic calculations using the method
8 outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
9
10 C. Friction losses in pipe will be based on a value of "C" = 120 in the Hazen and Williams
11 formula.
12
13 D. Design and install the system so that no part will interfere with doors, windows, heating,
14 mechanical, lighting, or electrical equipment. Do not locate sprinkler heads closer than 3 feet
15 to lighting fixtures or other obstructions.
16

17 3.2 LOCATION
18

- 19 A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design.
20 Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling
21 tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings,
22 locate the sprinkler heads symmetrically arranged with respect to both axes of the room.
23 Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels,
24 grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or
25 spaced between, such elements. Center heads in corridors.
26
27 B. Locate heads as may be required for coordinated ceiling pattern, even through number of
28 heads exceed minimum code requirements.
29
30 C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other
31 such spaces not subject to public view need not be centered in ceiling patterns and may use a
32 straight drop from branch line.
33
34 D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in
35 NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the
36 ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall
37 be spaced at 6'-0" on center, minimum 6 inches and maximum 12 inches from glazing.
38
39 E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler
40 shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing
41 requiring fire exposure protection shall also utilize the Tyco window sprinklers.
42

43 3.3 PREPARATION
44

- 45 A. Ream pipes and tubes, clean off scale, rust, oxide, and dirt, inside and outside, before
46 assembly. Remove welding slag or other foreign material from piping.
47
48 B. Pipe beveled each end, per approved procedures.
49
50 C. Hammer clean and flush out piping after welding to remove scale, welding slag and other
51 debris.
52

53 3.4 CONNECTION
54

- 1 A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after
2 cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound
3 applied to male threads only.
4
- 5 B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.
6
- 7 C. Clamp cast iron water pipe at fittings with 3/4 inch rods and properly anchor and support.
8
- 9 D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.
10
- 11 3.5 COORDINATION
12
- 13 A. Coordinate the installation schedule for this work with the construction schedule for the Work
14 to ensure orderly progress with minimum delay.
15
- 16 B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper
17 and adequate provision for the installation and connection of this system.
18
- 19 C. Coordinate location and quantity of Siamese connections required for fire department
20 connection with Architect and local fire officials.
21
- 22 3.6 SURFACE CONDITIONS
23
- 24 A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work
25 of other trades and determine that work is complete enough to allow installation to begin.
26 Ensure that work of other trades has been installed in a manner to permit work of this Section
27 in accordance with approved design.
28
- 29 3.7 INSTALLATION
30
- 31 A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose
32 only heads.
33
- 34 B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.
35
- 36 C. Locate system drains and inspector's test connections in utility rooms, mechanical rooms or
37 other readily accessible areas not requiring access through ceiling. Coordinate sprinkler
38 system drain flow rates with plumbing system drainage capacities.
39
- 40 D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain
41 valve with brass cap and chain.
42
- 43 E. Locate outside alarms on wall of building and coordinate with Architect.
44
- 45 F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire
46 Marshall and/or all other authorities having jurisdiction.
47
- 48 G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each
49 type and wrench suitable for each head type.
50
- 51 H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in
52 ceilings.
53
- 54 I. Install pipe markers to identify fire protection.
55

- 1 J. Provide shield or deflector for sprinklers or equipment where electrical switchgear,
2 switchboards and motor control centers are in sprinkler protected spaces.
3
4 K. Install fire 2-1/2-inch department valve, maximum 5 feet above floor, complying with NFPA
5 14.
6
7 L. During construction, make one standpipe outlet available on each floor without delay, for fire
8 department use.
9
10 M. Provide 3-way standpipe outlets above roof.
11
12 N. Provide pressure gauges at the top of each standpipe as detailed on the drawings.
13
14 O. Provide drain for each standpipe.
15
16 P. Install valves with stems upright or horizontal, not inverted.
17
18 Q. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed
19 areas, per NFPA 13.
20
21 R. Install the complete fire sprinkler system in accordance with the approved shop drawings.
22
23 S. Perform piping installation in accordance with the provisions of the specifications, including
24 furnishing of required sleeves for fire sprinkler system pipes passing through rated walls,
25 floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for
26 concrete or CMU penetrations. Furnish size required for fireproofing and or insulation.
27 Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler
28 system pipes. Where pipes pass through concrete floors, furnish, and install wrought iron or
29 steel pipe sleeves made flush with the ceiling below and extending 2" above the finished
30 floor.
31
32 T. Do not cut or make holes in any part of the building except where shown on the approved
33 shop drawings.
34
35 U. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a
36 transparent plastic cover, giving brief instructions regarding control, emergency procedure,
37 and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard
38 is to be permanently attached to the riser indicating the location, and the basis of design
39 (discharge density and system demand).
40
41 V. Do not install exposed piping below structure in public area.
42
43 W. Provide heat tracing and insulation on wet piping systems exposed to freezing when not
44 installed in a heated space or installed by other acceptable methods of maintaining the piping
45 from freezing. Installation of heat tracing and insulation shall be in accordance with the latest
46 edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with
47 Division 26.
48

49 3.8 SECURING AND SUPPORTING
50

- 51 A. Support piping to maintain line and grade, with provision for expansion and contraction. Use
52 approved adjustable ring type or trapeze-type hangers connected to structural members of the
53 building. Single pipe runs to be supported by approved adjustable ring type hangers. Multiple
54 pipe runs to be supported by approved trapeze type hangers. Do not support piping from other
55 piping or structural joist bridging.
56

- 1 B. Provide supports both sides of elbows for pipe 6" and larger.
- 2
- 3 C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at
- 4 each floor. Support piping assemblies in chases so they are rigid and self-supported before the
- 5 chase is closed.
- 6
- 7 D. Support spacing: As recommended by the project structural engineer and support
- 8 manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest
- 9 pipe.
- 10

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

11

12 3.9 PIPE SUPPORTS

13

- 14 A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe
- 15 support. Hot-dip galvanize members and appurtenances when located outside. Sagging of
- 16 pipes or supports is not acceptable.
- 17
- 18 B. Adjustable ring type hangers shall be used for single pipe supports; Erico Model 115 NFPA
- 19 UL/FM. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a
- 20 spacer to assure that the lower U-strap will not move in on the bolt. All parts shall be zinc
- 21 plated carbon steel, or galvanized.
- 22

23 3.10 PIPE SLEEVES

24

- 25 A. Sleeves through masonry and concrete construction:
- 26 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
- 27 2. Size sleeve large enough to allow for movement due to expansion and to provide
- 28 continuous insulation.
- 29
- 30 B. Sleeves through gypsum wall construction.
- 31 1. Fabricate sleeves of 16-gauge galvanized sheet metal.
- 32
- 33 C. Sleeves through elevated slab construction.
- 34 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in
- 35 floor.
- 36
- 37 D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface.
- 38 Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on
- 39 grade floors shall not be sleeved except where penetrating waterproofing membrane or insect
- 40 control is required.
- 41
- 42 E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic
- 43 compound to make the space water and airtight.
- 44
- 45 F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product
- 46 and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- 47

- 1 G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings
2 exposed to view. At exterior walls, stainless steel sheet metal is to be used.
3
- 4 H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop,
5 rated to maintain the integrity of the time rated construction. Install in accordance with the
6 manufacturer's installation instructions. Comply with UL and NFPA standards for the
7 installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions,
8 walls, floors, etc.
9

10 3.11 CLEANING OF PIPING SYSTEMS
11

- 12 A. General cleaning of piping systems. Purge pipe of construction debris and contamination
13 before placing the systems in service. Provide and install temporary connections as required
14 to clean, purge, and circulate.
15

16 3.12 FLUSHING AND TESTING
17

- 18 A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13,
19 and NFPA 25.
20
- 21 B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and
22 all main piping up to valve.
23
- 24 C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for
25 each device, and verify alarm valve operation.
26
- 27 D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect /
28 Engineer 7 working days in advance.
29

30 3.13 EXCAVATING, TRENCHING, AND BACKFILLING
31

- 32 A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with
33 the specifications.
34

35 3.14 PIPE MARKERS
36

- 37 A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code
38 Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of
39 flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows, and
40 tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly
41 identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch
42 letters for 5-inch pipe and larger.
43
- 44 B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch
45 pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker
46 and direction of flow arrow tape; background colors of markers, arrows, and type for each
47 type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each
48 system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch
49 pipe and larger.
50
- 51 C. Install identification in the following locations:
52 1. Both sides of penetrations through walls, floors, and ceilings.
53 2. Close to valves or flanges.
54 3. Intervals on straight pipe runs not to exceed 50 feet
55 4. Apply marker where view is obstructed.
56

1 D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for
2 Identification of Piping Systems".
3

4 3.15 TESTING AND ACCEPTANCE
5

6 A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure
7 required approvals of the flushing operations.
8

9 B. Upon completion of the fire sprinkler system installation, test and retest the complete
10 installation and make corrections as necessary to obtain acceptance by the Fire Marshall
11 and/or any other authority having jurisdiction. Furnish test equipment and personnel required.
12

13 3.16 TRAINING
14

15 A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner's designated
16 personnel on the operation and maintenance of the automatic sprinkler system and associated
17 equipment. Owner's Operation and Maintenance Manual prepared for this project shall be
18 used during the instruction.
19

20
END OF SECTION

SECTION 22 01 00

PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.

PLUMBING OPERATING AND MAINTENANCE MANUALS

- B. Minimum ring size: 1 inch; Maximum ring size: 3 inches.
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2 inch x 11 inch.
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 - 4. Written text, as required to supplement product data for the particular installation:

- a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Each Contractor's coordination drawings.
 - k. As installed color coded piping diagrams.
 - l. Charts of valve tag number, with location and function of each valve.
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - n. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 22.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide backflow preventer certified test reports.
 10. Provide gas piping pressure test reports.

END OF SECTION

SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department
 - 5. Texas Department of Licensing & Regulations (TDLR)
 - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
 - 2. Able to furnish evidence of having contracted for and installed not less than three systems of comparable size and type that has served their Owners satisfactorily for not less than three years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

PLUMBING GENERAL PROVISIONS

- 1 A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various
2 elements of work. Determine exact locations from field measurements.
3

4 1.6 PROJECT RECORD DOCUMENTS
5

- 6 A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract
7 drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions
8 of work in which actual construction is at variance with the contract drawings. Mark the drawings
9 with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible
10 drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and
11 other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and
12 new underground and under slab piping with dimensioned locations and elevations of such
13 piping.
14

- 15 B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original
16 drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain
17 three sets of blue-line prints of each drawing, regardless of whether corrections were necessary
18 and include in the transmittal (two sets are for the Owner's use and one set is for the Architect /
19 Engineer's records). Delivery of these as-built prints and reproducible is a condition of final
20 acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives)
21 and AutoCad 2012 / Revit CAD files on disk (CD Rom).
22

- 23 C. As-Built drawings should indicate the following information as a minimum:
24 1. Indicate all addendum changes to documents.
25 2. Remove Engineer's seal, name, address and logo from drawings.
26 3. Mark documents RECORD DRAWINGS.
27 4. Clearly indicate: DOCUMENT PRODUCED BY
28 5. Indicate all changes to construction during construction. Indicate actual routing of all
29 piping, ductwork, etc. that were deviated from construction drawings.
30 6. Indicate exact location of all underground plumbing and flow line elevation.
31 7. Indicate exact location of all underground plumbing piping and elevation.
32 8. Indicate exact location of all underground electrical raceways and elevations.
33 9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
34 10. During the execution of work, maintain a complete set of drawings and specifications
35 upon which all locations of equipment, ductwork, piping, devices, and all deviations and
36 changes from the construction documents in the work shall be recorded.
37 11. Location and size of all ductwork and mechanical piping above ceiling including exact
38 location of isolation of domestic and plumbing valves.
39 12. Exact location of all electrical equipment in and outside of the building.
40 13. Fire Protection System documents revised to indicate exact location of all sprinkler
41 heads and zone valves.
42 14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
43 15. Cloud all changes.
44

45 1.7 SPACE REQUIREMENTS
46

- 47 A. Consider space limitations imposed by contiguous work in selection and location of equipment
48 and material. Do not provide equipment or material that is not suitable in this respect.
49

50 1.8 RELATION WITH OTHER TRADES
51

- 52 A. Carefully study all matters and conditions concerning the project. Submit notification of conflict
53 in ample time to prevent unwarranted changes in any work. Review other Divisions of these
54 specifications to determine their requirements.
55

- 56 B. Because of the complicated relationship of this work to the total project, conscientiously study the

relation and cooperate as necessary to accomplish the full intent of the documents.

- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for one year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit three copies of all certifications and test

reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit three copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each subcontractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4 inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.

1. Provide the training during the Owner's regular working day.
 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
1. Minimum of 8 hours dedicated instructor time.
 2. 4 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
1. One copy to the Owner.
 2. One copy to the Architect / Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.
- 3.5 EQUIPMENT IDENTIFICATION
- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
1. Designation approved by Architect / Engineer.
 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with ½ inch high letters and fastened with epoxy or screws.
- 3.6 OBSTRUCTIONS
- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all

1 available information has been provided.

- 2 2. Should obstruction be encountered, whether shown or not, alter routing of new work,
3 reroute existing lines, remove obstruction where permitted, or otherwise perform
4 whatever work is necessary to satisfy the purpose of the new work and leave existing
5 services and structures in a satisfactory and serviceable condition.
6

- 7 B. Assume total responsibility for and repair any damage to existing utilities or construction,
8 whether or not such existing facilities are shown.
9

10 3.7 PROTECTION

- 11
12 A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in
13 original manufacturer's condition.
14

15 END OF SECTION

SECTION 22 05 10

PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1 PART 2 - PRODUCTS

2
3 2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

4
5 PART 3 - EXECUTION

6
7 3.1 PROTECTION OF EQUIPMENT

8
9 A. Do not deliver equipment to the project site until progress of construction has reached the
10 stage where equipment is actually needed or until building is closed in enough to protect the
11 equipment from weather. Equipment allowed to stand in the weather will be rejected, and the
12 Contractor is obligated to furnish new equipment of a like kind at no additional cost to the
13 Owner.

14
15 B. Adequately protect equipment from damage after delivery to the project. Cover with heavy
16 tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint,
17 mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause
18 corrosion.

19
20 END OF SECTION

SECTION 22 05 11

PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.

- 1 C. Verify field measurements, above and underground piping connections and flows.
- 2
- 3 D. Demolition Drawings are based on casual field observation, and when available, existing
- 4 record documents. Report discrepancies to Architect before disturbing existing
- 5 installation, and immediately after such discrepancies are discovered.
- 6
- 7 E. Field verify existing conditions and actual utility uses prior to final connections. Existing
- 8 drawings may not have been available for all required information. Use pipe inspection
- 9 camera system to field verify existing sanitary / grease waste connections. Verify flow
- 10 direction and depth prior to connection to existing plumbing systems.
- 11
- 12 3.2 APPLICATION
- 13
- 14 A. Existing materials and equipment indicated on the drawings or in the specifications to be
- 15 reused shall be cleaned and reconditioned, including cleaning of piping systems prior to
- 16 installation and reuse.
- 17
- 18 B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse
- 19 on the project shall become the property of the Contractor and be removed from the site.
- 20
- 21 C. Material or equipment salvaged for Owner's use shall be carefully handled and stored
- 22 where directed by the Owner or the Architect / Engineer. Relocate material and / or
- 23 equipment as directed by Owner.
- 24
- 25 D. Materials and equipment not indicated to be removed or abandoned shall be reconnected
- 26 to the new system.
- 27
- 28 E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be
- 29 removed for Owner's review and salvaged by Contractor.
- 30
- 31 F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to
- 32 identify and document items to be salvaged for Owner's use.
- 33
- 34 G. Clean and repair existing materials and equipment that remain or are to be reused.
- 35
- 36 H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations,
- 37 for maintenance, and for repairs.
- 38
- 39 3.3 SEQUENCE AND SCHEDULE
- 40
- 41 A. Coordinate utility service outages with Utility Company, Architect and Owner.
- 42
- 43 B. Provide additional or temporary valves, piping and connections to maintain existing
- 44 systems in service during construction.
- 45
- 46 C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where
- 47 facilities in these areas are to remain in service, any related work to keep the facilities in
- 48 operation is specified in this Division. Maintain existing system in service until new
- 49 system is complete and ready for service. Disable system only to make switchovers and
- 50 connections. Obtain permission from Owner at least 48 hours before partially or
- 51 completely disabling system. Minimize outage duration. Make temporary connections to
- 52 maintain service in areas adjacent to work area. Maintain acceptable temperature and
- 53 humidity control within existing building during renovation activities.
- 54
- 55 D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new
- 56 or remodeled construction. Re-establish service that may be interrupted by remodeled

- 1 construction.
- 2
- 3 E. Refer to other drawings series for work in remodeled areas. Where facilities in these
- 4 areas are required to remain in service, any related work required to keep these facilities
- 5 in operation is specified in this Division.
- 6
- 7 F. Remove and replace existing piping coincident with the construction.
- 8
- 9 G. Remove or relocate existing piping or housekeeping pads as occasioned by new or
- 10 remodeled construction. Cap unused domestic piping beyond the new finish line.
- 11
- 12 H. Relocate all domestic piping as required to accommodate new work requiring
- 13 precedence.
- 14
- 15 I. Remove concrete housekeeping pad where materials or equipment have been removed.
- 16
- 17 J. Remove all known utilities that do not provide service to the buildings that remain.
- 18
- 19 K. Remove existing plumbing vent penetrations through roof not to be reused.
- 20

21 3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

22

- 23 A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated
- 24 on the drawings or required by the installation of new facilities. All removals and/or
- 25 dismantling shall be conducted in a manner as to produce maximum salvage. Salvage
- 26 materials shall remain the property of the Owner, and shall be delivered to such
- 27 destination as directed by the Owner's representative unless they are not wanted, then it
- 28 will be the responsibility of this Contractor to remove such items and properly dispose of
- 29 them. Materials and/or items scheduled for relocation and which are damaged during
- 30 dismantling or reassembly operations shall be repaired and restored to good operative
- 31 condition. The Contractor may, at his discretion, and upon approval of the Owner's
- 32 representative substitute new materials and/or items of like design and quality in lieu of
- 33 materials and/or items to be relocated.
- 34
- 35 B. All items to be relocated shall be carefully removed in reverse to original assembly or
- 36 placement and protected until relocated. The Contractor shall clean, repair, and provide
- 37 all new materials, fittings, and appurtenances required to complete the relocations and to
- 38 restore them to good operative order. All relocations shall be performed by workmen
- 39 skilled in the work and in accordance with standard practice of the trades involved.
- 40
- 41 C. When items scheduled for relocation and/or reuse are found to be in damaged condition
- 42 before work has been started on dismantling, the Contractor shall call the attention of the
- 43 Owner's representative to such items and receive further instructions before removal.
- 44 Items damaged in repositioning operations are the contractor's responsibility and shall be
- 45 repaired or replaced by the contractor as approved by the owner's representative, at no
- 46 additional cost to the Owner.
- 47
- 48 D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be
- 49 removed to points indicated on the drawings, specified, or acceptable to the Owner's
- 50 representative. Piping not scheduled for reuse shall be removed to the points at which
- 51 reuse is to be continued or service is to remain. Such services shall be sealed, capped, or
- 52 otherwise tied-off or disconnected in a safe manner acceptable to the Construction
- 53 Inspector. All disconnections or connections into the existing facilities shall be done in
- 54 such a manner as to result in minimum interruption of services to adjacent occupied
- 55 areas. Services to existing areas or facilities that must remain in operation during the

1 construction period shall not be interrupted without prior specific approval of the
2 Owner's representative hereinbefore specified.

3
4 E. Repair adjacent construction and finishes damaged during demolition and extension
5 work.

6
7 F. Maintain access to mechanical installations that remain active. Modify installation or
8 provide access panel as appropriate.

9
10 G. Extend existing installations using materials and methods compatible with existing
11 plumbing installations, or as specified.

12
13 H. Existing plumbing piping and devices found to need additional hangers installed should
14 be added at no additional cost to the Owner.

15
16 3.5 PROTECTION OF THE WORK

17
18 A. Provide adequate temporary support and auxiliary structure as necessary to ensure
19 structural value or integrity of affected portion of work.

20
21 B. Provide devices and methods to protect other portions of work from damage.

22
23 C. Execute fitting and adjustment of products to provide a finished installation to comply
24 with specified products, functions, tolerances and finishes.

25
26 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

27
28 A. Identification of Equipment: Provide new identification of all existing equipment to be
29 reused and located within the renovated areas. Do not include the description "existing".
30 Provide new nameplates for all existing plumbing equipment in renovated areas as
31 specified in Section 22 05 00 Plumbing General Provisions.

32
33 END OF SECTION

SECTION 22 05 12

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4 inch = 1 foot - 0 inch.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
 - 1. Ductwork shop drawings
 - 2. Coordination drawing specified in Division 26

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

1
2 F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical
3 equipment areas.

4
5 G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.
6

7 1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION
8

9 A. Submit only pages which are pertinent to the project. All options which are indicated on the
10 product data shall become part of the contract and shall be required whether specified are not.

11
12 B. Mark each copy of standard printed data to identify pertinent products, referenced to specification
13 section and article number.

14
15 C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams
16 and controls; component parts; finishes; dimensions and required clearances.

17
18 D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard
19 information and to provide information specifically applicable to the work. Delete information not
20 applicable.

21
22 E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the
23 following: "Comply, "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply"
24 statements.

25
26 F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by
27 specification section name and number. Separate all submittals into appropriate specification
28 section number. Do not combine specification sections.
29

30 1.5 MANUFACTURERS INSTRUCTIONS
31

32 A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up,
33 adjusting, calibrating, balancing and finishing.
34

35 1.6 CONTRACTOR RESPONSIBILITIES
36

37 A. Review submittals prior to transmittal.
38

39 B. Determine and verify:
40 1. Field measurements
41 2. Field construction criteria
42 3. Manufacturer's catalog numbers
43 4. Conformance with requirements of Contract Documents
44

45 C. Coordinate submittals with requirements of the work and of the Contract Documents.
46

47 D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals
48 from requirements of the Contract Documents.
49

50 E. Do not fabricate products, or begin work for which submittals are specified, until such submittals
51 have been produced and bear contractor's stamp. Do not fabricate products or begin work
52 scheduled to have submittals reviewed until return of reviewed submittals with
53 Architect/Engineer's acceptance.
54

55 F. Contractor's responsibility for errors and omissions in submittals is not relieved whether
56 Architect/Engineer reviews submittals or not.

- 1
2 G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents
3 is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer
4 gives written acceptance of the specific deviations on reviewed documents.
5
6 H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
7 1. Proper sizes and capacities
8 2. That the item will fit in the available space in a manner that will allow proper service
9 3. Construction methods, materials and finishes
10
11 I. Schedule submissions at least 15 days before date reviewed submittals will be needed.
12
13 1.7 SUBMISSION REQUIREMENTS
14
15 A. Make submittals promptly in accordance with approved schedule, and in such sequence as to
16 cause no delay in the Project or in the work of any other Contractor.
17
18 B. Number of submittals required:
19 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and
20 three opaque reproductions.
21 2. Product Data: Submit the number of copies which the contractor requires, plus those
22 which will be retained by the Architect/Engineer.
23
24 C. Accompany submittals with transmittal letter, in duplicate, containing:
25 1. Date
26 2. Project title and number
27 3. Contractor's name and address
28 4. The number of each Shop Drawing, Project Datum and Sample submitted
29 5. Other pertinent data
30
31 D. Submittals shall include:
32 1. The date of submission
33 2. The project title and number
34 3. Contract Identification
35 4. The names of:
36 a. Contractor
37 b. Subcontractor
38 c. Supplier
39 d. Manufacturer
40 5. Identification of the product
41 6. Field dimensions, clearly identified as such
42 7. Relation to adjacent or critical features of the work or materials
43 8. Applicable standards, such as ASTM or federal specifications numbers
44 9. Identification of deviations from contract documents
45 10. Suitable blank space for General Contractor and Architect/Engineer stamps
46 11. Contractor's signed and dated Stamp of Approval
47
48 E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
49 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
50 2. Associated items which require correlation for efficient function or for installation
51
52 1.8 SUBMITTAL SPECIFICATION INFORMATION
53
54 A. Every submittal document shall bear the following information as used in the project manual:
55 1. The related specification section number
56 2. The exact specification section title

- 1
2 B. Submittals delivered to the Architect/Engineer without the specified information will not be
3 processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.
4

5 1.9 RESUBMISSION REQUIREMENTS
6

- 7 A. Make re-submittals under procedures specified for initial submittals.
8 1. Indicate that the document or sample is a re-submittal
9 2. Identify changes made since previous submittals
10
11 B. Indicate any changes which have been made, other than those requested by the Architect /
12 Engineer.
13

14 1.10 CONTRACTOR'S STAMP OF APPROVAL
15

- 16 A. Contractor shall stamp and sign each document certifying to the review of products, field
17 measurements and field construction criteria, and coordination of the information within the
18 submittal with requirements of the work and of Contract Documents.
19
20 B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and
21 Architect/Engineer that Contractor has either determined and verified all quantities, dimensions,
22 field construction criteria, materials, catalog numbers, and similar data or assumes full
23 responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with
24 the requirements of the work and the Contract Documents.
25
26 C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of
27 approval and signature.
28
29 D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and
30 signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal
31 had been delivered.
32

33 1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS
34

- 35 A. The Architect/Engineer will:
36 1. Review identified submittals with reasonable promptness and in accordance with
37 schedule
38 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or
39 approval of submittal
40 3. Return submittals to Contractor for distribution or for resubmission
41
42 B. Review and approval of submittals will not extend to design data reflected in submittals which is
43 peculiarly within the special expertise of the Contractor or any party dealing directly with the
44 Contractor.
45
46 C. Architect/Engineer's review and approval is only for conformance with the design concept of the
47 project and for compliance with the information given in the contract.
48 1. The review shall not extend to means, methods, sequences, techniques or procedures of
49 construction or to safety precautions or programs incident thereto.
50 2. The review shall not extend to review of quantities, dimensions, weights or gauges,
51 fabrication processes or coordination with the work of other trades.
52
53 D. The review and approval of a separate item as such will not indicate approval of the assembly in
54 which the item functions.
55

56 1.12 SUBSTITUTIONS

1
2
3
4
5
6
7
8
9
10

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 22 05 13

ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for plumbing equipment.
 - 2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
 - 5. Pipe heat tracing.
- C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.
- F. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.
- G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

ELECTRICAL PROVISIONS OF PLUMBING WORK

- 1
2 A. Provide motors for plumbing equipment manufactured by one of the following:
3 1. Baldor Electric Company.
4 2. Century Electric Div., Inc.
5 3. General Electric Co.
6 4. Louis Allis Div.; Litton Industrial Products, Inc.
7 5. Lincoln Electric
8 6. Marathon Electric Mfg. Corp.
9 7. Reliance Electric Co.
10 8. Westinghouse Electric Corp.
11
12 B. Motor Characteristics. Except where more stringent requirements are indicated, and except
13 where required items of plumbing equipment cannot be obtained with fully complying
14 motors, comply with the following requirements for motors of plumbing work:
15
16 C. Temperature Rating. Rated for 40 deg. C environment with maximum 50 deg. C temperature
17 rise for continuous duty at full load (Class A Insulation).
18
19 D. Provide each motor capable of making starts as frequently as indicated by automatic control
20 system, and not less than 5 starts per hour for manually controlled motors.
21
22 E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for $\frac{3}{4}$
23 hp and larger, and provide capacitor-start single-phase motors for $\frac{1}{2}$ hp and smaller, except
24 $\frac{1}{6}$ hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate
25 current characteristics with power specified in Division 26 sections, and with individual
26 equipment requirements specified in other Division 22 requirements. For 2-speed motors
27 provide two separate windings on polyphase motors. Do not purchase motors until power
28 characteristics available at locations of motors have been confirmed, and until rotation
29 directions have been confirmed.
30
31 F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
32
33 G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C"
34 where required for high starting torque.
35 1. Frames. NEMA #56.
36 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable
37 except permanently sealed where motor is inaccessible for regular maintenance.
38 Where belt drives and other drives produce lateral or axial thrust in motor, provide
39 bearings designed to resist thrust loading. Refer to individual section of Division 22
40 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
41 3. Except as indicated, provide open drip-proof motors for indoor use where
42 satisfactorily housed or remotely located during operation, and provide guarded drip-
43 proof motors where exposed to contact by employees or building occupants. Provide
44 weather-protected Type I for outdoor use, Type II where not housed. Refer to
45 individual sections of Division 22 for other enclosure requirements.
46 4. Provide built-in thermal overload protection and, where indicated, provide internal
47 sensing device suitable for signaling and stopping motor at starter.
48 5. Noise Rating: Provide "Quiet" rating on motors.
49
50 H. All motors shall be premium efficiency.

51
52 2.2 EQUIPMENT FABRICATION
53

- 54 A. Fabricate plumbing equipment for secure mounting of motors and other electrical items
55 included in work. Provide either permanent alignment of motors with equipment, or
56 adjustable mountings as applicable for belt drives, gear drives, special couplings and similar

indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 22 05 15

PLUMBING EARTHWORK

PART 1 - GENERAL

- A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.
- B. Cut the bottom of the trench or excavation to uniform grade.
- C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.
- D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

- A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.
- B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95 percent of maximum soil density as determined by ASTM D-698 Standard Proctor.
- C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.
- D. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe.

3.3 DISPOSAL OF EXCESS MATERIAL

- A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner/Architect.

END OF SECTION

SECTION 22 05 16

EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES OUTSIDE BUILDING SLAB

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
- B. Refer to Instructions to Bidders for substitution of materials and products.
- C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

- A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.
- B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- A. Earthwork
- B. Water Distribution
- C. Sanitary Sewer
- D. Plumbing

1.4 REFERENCES

- A. American Society for Testing and Materials (ASTM) Use current edition.
 - 1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
 - 2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - 4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- B. City Standards
- C. Local Governing Agencies
- D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

- 1 A. Provide written warranty against defects in the material and workmanship for the work of this
2 Section for a period of one year from the Date of Substantial Completion of the Project. Refer
3 to Division 1 for Warranty form.
4

5 PART 2 – PRODUCTS
6

7 2.1 MATERIALS
8

- 9 A. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland
10 cement per ton; mix in a mill-type mixer.
11
12 B. Sand: Clean, local sand
13
14 C. Earth Backfill: Clean local material consistent with the surrounding earth material and free of
15 large clods, roots, rocks or other debris.
16

17 PART 3 – EXECUTION
18

19 3.1 EXCAVATION
20

- 21 A. General:
22 1. All utility trenches shall be constructed in conformance with OSHA trench safety
23 standards.
24 2. Sheet piling and shoring shall be accomplished to the extent necessary to maintain the
25 sides of the trench in a vertical position throughout the construction period for
26 trenches five feet in depth or deeper. Where approved, trench sides may be laid back
27 in lieu of shoring to meet OSHA safety standards.
28 3. Utilities shall not be constructed or laid in a trench in the presence of water. All
29 water shall be sufficiently removed from the trench prior to the line placing
30 operation to ensure a dry, firm bed on which to place the utility line.
31
32 B. Storm and Sanitary Sewer Trenches:
33 1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be
34 outside diameter of pipe plus 18 inches.
35 2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.
36
37 C. Appurtenances:
38 1. Any overdepth excavation below appurtenances shall be refilled with cement-
39 stabilized sand.
40
41 D. Water Line Trenches:
42 1. Water lines shall be at least two feet in depth from the top of proposed grade to the
43 top of pipe.
44 2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18
45 inches.
46 3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.
47

48 3.2 PIPE BEDDING AND BACKFILL
49

- 50 A. Storm and Sanitary Sewer Trenches:
51 1. The cement-stabilized sand bedding shall not extend from a point 6 inches below the
52 bottom of the pipe to the level of the spring line. This material shall not be used after
53 it loses its moisture content.
54 2. The cement-stabilized sand shall be thoroughly rodded after being placed in the
55 trench.

3. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill shall be placed to one foot above the top of pipe for earth backfill and 6 inches over the top of pipe for cement-stabilized sand backfill.
4. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
5. Backfill shall be placed in uniform layers not to exceed 8 inches loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D698).
6. Backfill, under pavement and to one foot from outer edge, shall be cement-stabilized sand, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 5 above and stabilized where required.

B. Water Line Trenches:

1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95 percent Standard Proctor.
4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8 inch loose depth. Each lift shall be compacted to a minimum of 90 percent of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.

C. Natural Gas Trenches:

1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
2. Natural gas lines shall not be installed in trenches with other utilities.

D. Utility Locators:

1. Provide metallic locator over all underground utilities, including irrigation piping, plumbing, control wiring, conduit, data, etc. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION

SECTION 22 05 17

PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Prime coat finish
- F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor

1 B. MIFAB

2 C. Acudor

3 D. Elmdor

4
5
6
7 PART 3 - EXECUTION

8
9 3.1 INSTALLATION

10
11 A. Access doors specified in Division 22 will be installed by other crafts. Not all required access
12 doors are shown. Coordinate with the Contractor to locate access doors for ease of operation
13 and maintenance of concealed equipment.

14
15 B. Installation shall be in accordance with the manufacturer's printed instructions.

16
17 C. Minimum size required:

18 1. 24 inch x 24 inch for plumbing multiple isolation valves and electrical related items
19 in ceilings

20 2. 8 inch x 8 inch for plumbing for single isolation valve or shock arrestor

21
22 END OF SECTION

SECTION 22 05 19

PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 22, Plumbing
 - 1. Plumbing General Provisions
 - 2. Pipe and Pipe Fittings, General
 - 3. Valves, Strainers and Vents

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Terice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4 inch type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1 percent over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: Domestic Water 4CTS LF (Lead Free) 0-100 PSI

PRESSURE AND TEMPERATURE INSTRUMENTS

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.
- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50 percent into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9 inch scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections (Lead Free).
- H. Accuracy: +/- 1 percent of scale range.
- I. Range:
 - 1. Hot water lines: 30 deg. F to 240 deg. F.

2.5 PRESSURE AND TEMPERATURE TEST STATIONS

- A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel (Lead Free).
 - 1. Fitted with a color coded cap strap with gasket.
 - 2. Acceptable Manufacturer: Peterson Equipment Company.
 - 3. Provide with extension neck to match insulation thickness.
- B. Provide to the Owner a fitted case with:
 - 1. Two 0-100 psi pressure gauges as specified and adapters with 1/8 inch OD probe.
 - 2. Four 5 inch stem pocket testing thermometers.
 - a. Two with range 0 deg. F to 220 deg. F for hot water.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge (Lead Free).
- C. Locate gauges and thermometers to be easily readable from the floor at a 5 foot-6 inch eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.

- 1 D. Install gauges in the following locations: across pumps, storage tanks, heat exchangers.
2
3 E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across
4 boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water
5 supply and return lines.
6 1. Hot water lines: 30 deg. F to 240 deg. F.
7 2. Tempered water valves 0 deg. F to 120 deg. F.
8

9 END OF SECTION

SECTION 22 05 23

VALVES, STRAINERS, AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves
- B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
 - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450 deg. F.
 - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
- B. Butterfly Valves
 - 1. Butterfly valves shall conform to MSS-SP67.
 - 2. Liners, inserts and discs shall be suitable for the intended service.
 - 3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
 - 4. All valves for domestic use must be lead free.
- C. Balancing Valves
 - 1. Provide balancing valves with:
 - a. Corrosion resistant plug with resilient seal when required.
 - b. O-ring stem seal.
 - c. Permanently lubricated, corrosion resistant bearings.
 - 2. Connections
 - a. Through 2 inch pipe size use threaded connections.
 - b. For valves 2-1/2 inch pipe size and larger shall be provided with 150 psig flange connections.
 - 3. Provide each valve with:
 - a. Memory stop.
 - b. Plastic drip cap.
 - c. 1/8 inch gauge tap.
 - 4. All valves for domestic use must be lead free.
- D. Ball Valves
 - 1. Provide ball valves with:
 - a. Blowout proof stem.
 - b. Full size port, 316 stainless steel ball and stem.
 - c. Cast bronze body.
 - d. Threaded ends.
 - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
 - 3. Service rating:
 - a. 150 psi saturated steam.
 - b. 600 psi WOG.
 - 4. Provide with memory stop for balancing valves.

VALVES, STRAINERS, AND VENTS

5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
6. All valves for domestic use must be lead free.

E. Globe and Angle Valves

1. Bronze body 2 inches and smaller, bronze plug disc and renewable seat ring, union bonnet, malleable iron hand wheel, standard packing with bronze gland follower.
2. Iron body 2-1/2 inches and larger, bronze mounted disc and bronze seat ring, outside screw and yoke, standard packing with gland follower.
3. Globe valves shall be designed for repacking under pressure when fully opened.
 - a. Equipped with packing suitable for the intended service.
4. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid.

F. Valve Connections

1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
2. Thread pipe sizes 2 inches and smaller.
3. Flange pipe sizes 2-1/2 inches and larger.
4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
6. Use press valves when using copper press systems.

G. Valve Operators

1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
2. When cocks and valves are furnished with square head stem:
 - a. Provide one wrench for every ten cocks or valves sized 2 inches and smaller, minimum of two.
 - b. Provide each cock or valve size 2-1/2 inches and larger with a wrench with setscrew.
3. Where butterfly valves are provided:
 - a. Provide gear operators on valves 6 inches and larger.
 - b. Where valves are located 7 feet or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5 feet above floor and hook to clips, arrange to clear walking space.
 - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4 inches and smaller.

H. Acceptable Manufacturers (All listed must be lead free):

1. Apollo
2. Kitz
3. Milwaukee Valve
4. Nibco
5. Stockham

I. Check Valves

1. Bronze body, 2 inches and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection (Lead Free).
2. Iron body, 2-1/2 inches and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug (Lead Free).
3. Acceptable Manufacturers (All listed must be lead free):
 - a. Apollo
 - b. Kitz
 - c. Milwaukee

- 1 d. Nibco
- 2
- 3 J. Backflow Preventer (All valves for domestic use must be lead free):
- 4 1. BFP-1 (2 inches and smaller) bronze body, reduced pressure zone type with two
- 5 inline independent check valves with an intermediate relief valve, complete with two
- 6 full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet.
- 7 Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-
- 8 QT-S-LF.
- 9 2. BFP-2 (2-1/2 inches and larger) stainless steel or FDA epoxy coated ductile iron
- 10 reduced pressure zone type with two inline independent check valves with reverse
- 11 relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on
- 12 inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo RP4ALF-
- 13 YS or Watts 909-NRS-BB-S-LF.
- 14
- 15 K. Provide valves of same manufacturer throughout where possible.
- 16
- 17 L. Provide valves with manufacturer's name and manufacturing location, duty and pressure
- 18 rating clearly marked on outside of body.
- 19
- 20 M. Where valves are installed in insulated piping, provide with extended neck so valve operator
- 21 and stop plate clears the full thickness insulation.
- 22
- 23 N. Provide valve, seat and trim materials suitable for the intended service.
- 24
- 25 O. Provide memory stops for all valves used for throttling service. Valves for throttling service
- 26 shall be butterfly, plug, globe or ball type.
- 27
- 28 2.2 PIPE SYSTEMS STRAINERS
- 29
- 30 A. Body:
- 31 1. Bronze "Y" pattern or basket as shown on the drawings.
- 32 2. Line size.
- 33 3. Threaded strainer blow down port.
- 34 4. ASTM A #126 Class B Cast Iron Body.
- 35
- 36 B. Construction:
- 37 1. 2 inch size and smaller with screw connections rated 400 psi WOG.
- 38 2. Over 2 inch size with flanged connections, rated 125 psi WOG.
- 39
- 40 C. Fabricate screens of Monel or type 304 stainless steel:
- 41 1. With 20 mesh woven wire in piping systems through 2 inches.
- 42 2. With 0.045 perforations in piping systems 2-1/2 inches and 3 inches.
- 43 3. With 0.125 perforations in piping systems 4 inches and larger.
- 44
- 45 D. Start-up:
- 46 1. Provide an additional fine mesh disposable screen for use during start-up operations.
- 47 2. Remove after 30 days.
- 48 3. Attach to piping for Owner's review.
- 49
- 50 E. Acceptable Manufacturers (All listed must be lead free):
- 51 1. Apollo
- 52 2. Crane
- 53 3. Keckley
- 54 4. Kitz
- 55 5. Mueller
- 56 6. McAlear

- 7. Muesco
- 8. Nibco
- 9. Zurn

2.3 VALVE SCHEDULE

A. Domestic Service

1. Gas shut-off service: UL approved for natural gas service.
 - a. Nibco Ball Valve, full port through 1 inch: T-585-70-UL
 - b. Nibco Ball Valve conventional port 1-1/4 inch through 3 inch: T-580-70-UL
 - c. Resun 2-1/2 inch and larger: 143 - 1-UL
 - d. DeZurick 2-1/2 inch and larger: Series 425 or 435
 - e. Locking Type: Rockford 3/4 inch and 1 inch PNP-400
Mueller 1-1/4 inch through 4 inch: Lub-O-seal
 - f. Conbraco Ball Valve, full port through 4 inch: 64-100 Series
 - h. Milwaukee Full Port 1/4 inch-2 inch
 - i. Milwaukee Standard Port 2-1/2 inch & 3 inch
 - j. Kitz Full Port 2 inch -- #68
2. Cold and Hot water service (all listed must be Lead Free):
 - a. Nibco Ball Valve full port through 2 inch: T-585-66-LF
 - b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-66-LF
 - c. Nibco Butterfly Valve 4 inch and larger: LD-2000 EDPM Gaskets
 - d. Watts Ball Valve 4 inch and larger: G-4000-FDA
 - e. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
 - f. Kitz Full Port through 2 inch - #868M Lead Free
 - h. Milwaukee Full Port 1/4 inch-2 inch
 - i. Milwaukee Standard Port 2-1/2 inch & 3 inch
 - j. Apollo Ball Valve Full Port through 2-1/2 inch 77CALF
 - k. Apollo Ball Valve Standard Port 3 inch 70LF
 - l. Apollo Butterfly Valve 4 inch and Larger LD141
 - m. Apollo Press Bronze Ball valves – 77 WLF
3. Compressed air system
 - a. Nibco Ball Valve full port through 2 inch: T-585-70-66
 - b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-70-66
 - c. Watts Ball Valve 4 inch and larger: G-4000
 - d. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
 - e. Milwaukee Valve Full Port through 2 inch – BA-400S
 - f. Apollo Ball valve full port through 1-1/2 inch 77CA
 - g. Apollo Ball Valve standard port 3 inch 70
 - h. Apollo Press Bronze Ball valves: 77W
4. Check Valve (All listed must be Lead Free):
 - a. Nibco Check Valve: T - 413 - Y -LF (Teflon Seats)
 - b. Nibco Check Valve 2-1/2 inch and larger: F - 918 – Y -LF (Buna-N disc.)
 - c. Nibco Check Valve 2-1/2 inch and larger: W - 920 -W-LF (Wafer)
 - d. Kitz Y & Check: A-22T
 - e. Kitz 2-1/2 inch and Larger #778 C.I.
 - f. Kitz Wafer Check 2-1/2 inch and Larger #7032
 - g. Milwaukee Valve – 509T
 - h. Apollo Check Valve: 163TLF
 - i. Apollo Check Valve 2-1/2 inch and larger: 910FLF
 - j. Apollo Press Check Valve: 163TPR-LF
 - k. Apollo Check Valve 2 inch and larger 910WE-LF (Wafer)
5. Globe Valve:

- a. Nibco Globe Valve: T - 235 - Y (Teflon Seats)
- b. Nibco Globe Valve 2-1/2 inch and larger: F - 718 - B (Bronze Seats)
- c. Milwaukee Valve 590T
- d. Apollo Globe Valve – 120T (Teflon Seats)
- e. Apollo Glove Valve 121T (Bronze Seats)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.
- D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.
- E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
 - 1. 1 inch valve for pipes 6 inch and larger.
 - 2. 3/4 inch valve for pipes smaller than 6 inch.
 - 3. Terminate with pipe plug.
 - 4. Drain valves shall be ball valves.
- F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
- G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- H. Provide clearance for installation of insulation and access to valves.
- I. Provide access where valves are not exposed.

3.2 VALVE TAGS

- A. Furnish valves with 1-1/2 inch diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 2 inch letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3 feet of the equipment being served and the service is obvious.
- B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

1
2
3
4
5

- A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

SECTION 22 05 33

PIPE HEAT TRACING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.
- B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

- A. Submit shop drawings and product data as specified in Section 22 05 12.
- B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.
- C. Submit manufacturer's certified capacity charts with selections plotted thereon.
- D. Submit manufacturer's installation instructions.
- E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Raychem Corporation
- B. Thermon Manufacturing Company

2.2 COMPONENTS

- A. Self-regulating heater.
 - 1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
 - 2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
 - 3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
 - 4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
 - 5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
 - 6. Power connection, end seal, splice and tee kits components shall be applied in the field.

7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.
- B. Install the pipe heat tracing cable under the pipe insulation.
- C. Apply "Electrically Traced" signs to the outside of the thermal insulation.
- D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.
- E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.
- F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

- A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.
- B. The specified wiring work includes:
 1. Wiring of control instruments between thermostat and junction boxes
 2. Installation of thermostat and junction boxes
 3. Wiring from the heat tracing cable to the junction boxes
- C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.
- D. Provide devices and appurtenances as specified in Division 26.
- E. Identify each circuit at each terminal with a separate tag.
- F. Color code wires in accordance with IPCEA Standards.
- G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

- A. Test the pipe heat tracing system:
 1. Simulate freezing outside air conditions
 2. Measure the amperage draw of the heat tracing system
 3. Compare to the manufacturer's capacity rating of the actual system
 4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.

1
2
3
4
5

- B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

PLUMBING PIPING INSULATION

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
 - 1. Johns-Manville Micro-Lok AP-T
 - 2. Owens-Corning ASJ/SSL
 - 3. Knauf ASJ/SSL
- B. Cellular Glass Insulation (Foamglass):
 - 1. Pittsburg Corning
 - 2. Cell-U-Foam
- C. Aluminum Jacketing:
 - 1. Childers
 - 2. Pabco
 - 3. RPR
- D. Fiberglass reinforcing cloth mesh:
 - 1. Perma Glass Mesh
 - 2. Alpha Glass Mesh
 - 3. Childers Chil-Glas
 - 4. Vimasco
- E. Mastics and Adhesives
 - 1. Childers
 - 2. Foster
 - 3. Vimasco
 - 4. Armstrong 520 Adhesive
- F. Elastomeric Insulation
 - 1. Armacell
- G. Weather Resistant Coating
 - 1. WB Armaflex Finish
- H. Glass fiber blanket insulation
 - 1. Manville R-series Microlite FSKL
 - 2. Owens-Corning eD75 or ED100 RKF
 - 3. Knauf 0.75 PCF FSK

2.2 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
 - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than 3/4" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum 3/4" thick.

- 1 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)
- 2
- 3 2.4 CELLULAR GLASS INSULATION
- 4
- 5 A. ASTM C552:
- 6 1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
- 7 2. 8.0 lb./cu.ft. (128 kg/cu.m.) density
- 8
- 9 2.5 INSULATION/SHIELD AT HANGERS
- 10
- 11 A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area
- 12 at hangers and supports. Further support insulation at hangers and supports with a shield of
- 13 galvanized metal covering at least half of the pipe circumference, and conforming to the schedule.
- 14 Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top
- 15 and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to
- 16 insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per
- 17 shield.
- 18 1. Sections of foam glass insulation may be used of the same outside diameter of the
- 19 adjoining pipe insulation.
- 20 2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- 21
- 22 B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit
- 23 pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation
- 24 outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and
- 25 above.
- 26
- 27 2.6 SEALANT, ADHESIVE AND FINISH
- 28
- 29 A. Lap Adhesive. Provide Childers CP-82 adhesive.
- 30
- 31 B. Vapor Barrier Finish:
- 32 1. Indoors: Provide as insulation coating Childers CP-35, white.
- 33 2. Outdoors: Provide as insulation coating Childers Encacel X.
- 34 3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
- 35
- 36 C. Sealant. Provide Childers CP-76 vapor barrier sealant.
- 37
- 38 D. Lagging Adhesive. Provide Childers CP-50.
- 39
- 40 E. Other products of equal quality will be acceptable only upon approval.
- 41
- 42 2.7 ALUMINUM JACKETING
- 43
- 44 A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016"
- 45 thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers
- 46 Lock-On or approved equal.
- 47
- 48 B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations,
- 49 provide formed aluminum covers, 0.024" thick.
- 50
- 51 C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers
- 52 according to manufacturer's recommendations.
- 53
- 54 2.8 GLASS FIBER BLANKET INSULATION
- 55
- 56 A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing

of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.
- C. Where domestic water pipes (1/2" & 3/4" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
 - 1. All hot and cold water.
 - 2. Make-up water
 - 3. Horizontal sanitary drain piping that receives condensate
 - 4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down

3.2 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with 1/2" wide glass filament tape.
- D. Apply a tack coat of fitting mastic over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
- F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on

straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.

1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
5. Apply mastic to a wet film thickness of 3/64".
6. Fabric shall not be visible after completion.
7. Vapor seal flanges, valves and fittings with Childers CP-35.

B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal.

C. Install straps on 9" centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrum-Kraft (FSK) facing. Install insulation of clean, dry piping.

B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.

C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.

- 1 D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.
- 2
- 3 3.6 MISCELLANEOUS
- 4
- 5 A. Install materials after piping has been tested and approved.
- 6
- 7 B. Apply insulation on clean, dry surfaces only.
- 8
- 9 C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces.
- 10 Provide a minimum of three coats.
- 11

12 3.7 INSULATION THICKNESS

13

<u>INSULATED UNIT</u>	THICKNESS <u>(Inches)</u>
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

21

22 END OF SECTION

SECTION 22 08 00

PLUMBING COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 22 Plumbing.
- B. Related Sections:
 - 1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
 - 2. Division 22 – Plumbing
 - 3. Division 23 – Mechanical
 - 4. Division 26 – Electrical

1.2 DEFINITIONS

- A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

- A. The Owner will contract directly for commissioning services.
 - 1. Commissioning Agent fee will be paid for directly by the owner.
 - 2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing is listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0°F and a resolution of + or - 0.2°F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

- A. Ladders and/or lifts and appropriate fall protection as required by Contractor site requirements.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

- A. Except for the activities to be performed by the CxA called for herein, all component and system

1 installation work required by the Division 22, 23 and 26 specifications including specific
2 contractor furnished items indicated by this Section shall be provided by the Contractor.

3
4 3.2 SUBMITTALS

- 5
6 A. Plumbing
7 1. Plumbing Equipment.

8
9 3.3 EQUIPMENT START-UP

- 10
11 A. Notification
12 1. Contractor shall provide ten Owner business days' notice to CxA, Owner and Design
13 Team of start-up dates.
14
15 B. Prior to start-up, contractor shall:
16 1. Verify that equipment and systems are complete, accessible, correctly connected to
17 utilities and ready for operation. Perform all pre-start inspections and tests as called
18 for in Division 22.
19 2. Comply with pre-start requirements of manufacturer and complete applicable
20 documentation.
21 3. Complete applicable sections of Pre-functional Checklists.
22 4. Coordinate start-up attendance by manufacturer or authorized representative as
23 required by specifications or manufacturer.
24
25 C. At start-up, contractor shall:
26 1. Supervise the activities of the authorized start-up technician or manufacturer's
27 representative.
28 2. Verify proper voltage, phase, drive rotation and any other conditions that may cause
29 damage if not correct.
30 3. Execute start-up under supervision of qualified contractor and equipment
31 manufacturer personnel and in accordance with the manufacturer's instruction.
32 4. Complete manufacturer start-up requirements and documentation. Provide a copy of
33 documentation to the CxA for inclusion in the Cx Manual.
34 5. Complete PFC's and provide documentation to CxA.
35 6. Provide documentation of any issues noted during start-up to CxA, Owner and Design
36 Team. Outline recommendations for corrective action.

37
38 3.4 PRE-FUNCTIONAL CHECKLISTS

- 39
40 A. Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx
41 documentation. PFC's will be provided by the CxA. As an alternate, contractor shall submit
42 their versions of the PFC's to the CxA for review and comment.
43
44 B. Contractor shall complete PFC for each of the following equipment:
45 1. Plumbing:
46 a. Domestic Hot Water Heater/Converter
47 b. Recirculation Pump
48 c. Mixing Valve
49

50 3.5 FUNCTIONAL TESTING

- 51
52 A. General
53 1. Contractor shall organize and schedule Construction Team members to execute the
54 functional testing, which will be directed by CxA.
55

- END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

- A. Division 22 Plumbing
1. Valves, Strainers and Vents
 2. Pipe and Pipe Fittings - General
 3. Plumbing Piping Insulation
 4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Below Slab on Grade Piping for Water Entries:
1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
 2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a "bending" temper tubing.
 3. 4-inch and larger, provide ductile iron pipe with mechanical joints, ANSI A21.6.
 4. 3 inch and larger, provide one-piece stainless steel IBR (in building riser), Watts or Ames.
- B. Below Grade Piping Outside Building (beyond 5'-0" of building): Provide PVC water main pipe 4 inch through 12 inch in diameter in conformance with AWWA C900. When using 3" or smaller provide Schedule 40 PVC ASTM D1785 with ASTM D-2466 socket type fittings. Provide fittings in conformance with ASTM 2466. Furnish pipe with a minimum pressure rating of 150 lbs. per square inch. Provide PVC pipe as manufactured by Johns-Manville, CertainTeed, Clow or approved equal.
- C. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- D. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- E. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.
- F. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by

DOMESTIC WATER PIPING AND APPURTENANCES

submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.2 WATER HAMMER ARRESTORS

- A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.
- B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.
- C. All water hammer arrestors shall be installed in a vertical position.
- D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

PART 3 - EXECUTION

3.1 DRAINAGE

- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Inject chorine disinfectant in liquid, powder, tablet or gas form throughout the system to obtain 50 to 80 Mg/L residual.
- C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 20% of the outlets.
- D. Retain disinfectant in system for 8 hours (minimum), 24 hours (maximum). During the disinfection process, operate all valves and accessories.
- E. If final disinfectant residual tests less than 25 Mg/L, repeat treatment.
- F. Flush disinfectant from system until chemical and bacteriological tests prove water quality equal to that of the service main.
- G. Take samples no sooner than 24 hours after flushing from at least 10% of the outlets and from the water entry.
 - 1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
 - 2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.

- 1
2 H. After final flushing, remove aerators, clean and replace.
3
4 I. Chemical and bacteriological tests shall be conducted by a state certified laboratory.
5
6 J. The firm performing the disinfection shall have chemical laboratory experience.
7
8 K. Provide a laboratory report to indicate the following information.
9 1. Name and address of the approved laboratory testing the samples.
10 2. Name and location of the project and date the samples were obtained.
11 3. Mg/L chlorine during retention.
12 4. Mg/L chlorine after flushing.
13 5. The coliform organism count. (An acceptable test shall show absence of coliform
14 organisms.)
15
16 L. If analysis does not satisfy the specified minimum requirements, repeat the disinfection
17 procedure.
18
19 M. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification
20 of performance. An approved copy of each document shall be inserted in the Owner's manual.
21
22 3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES
23
24 A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted
25 soil.
26
27 3.4 TESTING
28
29 A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig
30 minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
31
32 B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
33
34 C. Use only potable water for the test.
35
36 D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
37
38 E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a
39 final test, employing the specified procedure.
40
41 F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
42
43 G. If any leaks or other defects are observed, suspend the test and correct the condition at once.
44 Repeat testing until leaks are eliminated and the full test period is achieved.
45
46 H. The satisfactory completion of testing does not relieve the Contractor of responsibility for
47 ultimate proper and satisfactory operation of piping systems and their accessories.
48
49 3.5 COPPER PIPE CORROSION PROTECTION
50
51 A. Corrosion protect copper tube piping systems:
52 1. In the building slab.
53 2. Beneath the building slab.
54 3. Buried.
55 4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper
56 tubing.

- 1
2 B. Cover copper tubing piping system with:
3 1. "Tapecoat" TC Primer.
4 2. "Tapecoat" CT cold applied coating tape.
5
6 C. Install coating system as specified by the manufacturer.
7
8 D. Extend the corrosion protection 2 inches above concrete slab on grade.
9

10 3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM
11

- 12 A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to
13 provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).
14
15 B. Make repairs to small holes in accordance with the manufacturer's instructions.
16
17 C. Retest the repairs using procedures listed above.
18
19 D. Furnish certificate of compliance with field testing in Owner's manual.
20
21

END OF SECTION

SECTION 22 13 16

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

A. Site Work:

1. Sanitary Sewers
2. Excavation, Trenching and Backfilling for Utilities

B. Division 22 Plumbing:

1. Pipe and Pipe Fittings
2. Plumbing Fixtures and Fixture Carriers
3. Drains, Cleanouts and Hydrants
4. Earthwork

1.3 REFERENCES

- A. CISPI - Cast Iron Soil Pipe Institute
- B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All No-Hub clamps must have 4 bands minimum. Sizes 5" through 10" shall have six bands minimum.

1. No-Hub Clamps – Sanitary Waste:
 - a. Husky SD 4000
2. No-Hub Clamps - Vents
 - a. Husky SD – 2000
 - b. Mission Rubber Co., LLC Heavy Weight Couplings
3. Clamp-All Hi-TorQ 80 or approved equal

- B. Provide Fernco "Pro-flex" shielded couplings Series 3000 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2" through 8" Series 3000.

C. Cast Iron Soil Pipe and Fittings:

1. AB&I
2. Charlotte Pipe and Foundry Co.
3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

A. Above Slab Pipe:

1. Service weight cast iron hub and spigot pipe and fittings.
2. Compression type, with neoprene gaskets shall conform to ASTM C-564.
3. Pipe shall conform to requirements of ASTM A74.

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

- 1 4. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of
2 the Cast Iron Soil Pipe Institute
3
- 4 B. Below Slab on Grade Piping:
5 1. Schedule 40 PVC plastic pipe and DWV fittings.
6 2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
7 3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665,
8 ASTM D 3311 and NPS Standard 14 & 61.
9
- 10 C. Below Slab on Grade Piping for Grease Waste:
11 1. Schedule 40 CPVC pipe and fittings.
12 2. Solvent welded DWV joints shall conform to ASTM D3311 and be produced to
13 dimensions specified in ASTM F 2618, NSF International, UPC, IAPMO IGS 210
14 and International Plumbing Code.
15 3. Solvent Cement, Heavy Body; mustard yellow color, as tested by ASTM F 2618 /
16 ASTM F493.
17 4. Manufacturer: Spears (only)
18
- 19 2.3 VENT PIPE AND FITTINGS
20
- 21 A. Above Slab Pipe:
22 1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
23 2. Pipe shall conform to ASTM A74.
24 3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF
25 International
26 4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
27
- 28 B. Below Slab on Grade Piping:
29 1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and
30 fittings shall conform to ASTM D1784-82.
31
- 32 C. Above Slab Pipe.
33 1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture
34 locations and plumbing equipment discharge piping.
35

36 PART 3 - EXECUTION

37 3.1 INSTALLATION

- 38 A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall
39 be in accordance with Cast Iron Soil Pipe Institute Standards.
40
- 41 B. Above ground installation in the horizontal position shall be supported at every hub (hub &
42 spigot or hubless type). Hangers are to be placed within 18" of hub or coupling. For large
43 diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every
44 branch opening or change of direction, braces, blocks, rodding or other suitable method shall
45 be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
46
- 47 C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in
48 accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per
49 manufacturer's recommendations and applicable standards.
50
- 51 D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside
52 the building slab.
53
- 54 E. All PVC underground shall be installed in accordance with ASTM D2321.
55
56

3.2 GRADE

- A. Give horizontal pipe grade of 1/4-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

3.3 DRAIN PIPE AND FITTINGS

- A. Offsets and Fittings.
1. Use reduction fittings to connect two pipes of different diameter.
 2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eighth-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
 3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
 4. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8th bend fittings are not allowed for horizontal to horizontal piping systems per Code.
- B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.
- C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
 2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
 3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
 4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.
- D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

3.4 VENT PIPING

- A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.
- B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.
- C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

3.5 TESTING

- 1
2 A. Below Slab on Grade and All Floors in Multi-Story Buildings:
3 1. Test pipe below slab on grade before backfilling and connecting to city sewers.
4 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
5 3. Before acceptance of the work the contractor must ensure the piping is in working
6 order before and after the slab is poured. To ensure this the contractor must test
7 completed systems in the presence of the Architect, Engineer and authorities having
8 jurisdiction after installation is complete.
9 4. Maintain the test on the system till after the slab is poured. Provide an accessible
10 connection that may be reviewed by Architect, Engineer and authorities having
11 jurisdiction prior to and after the slab is poured.
12 5. Test drainage piping systems in accordance with governing codes and the
13 requirements specified. Provide equipment and materials and make test connections
14 required to execute tests.
15 6. Test drainage and waste piping hydraulically by filling system to its highest point or,
16 whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient
17 cause for rejection.
18 7. Air tests may be substituted for hydraulic tests by forcing air into the closed system
19 at a uniform pressure sufficient to balance a column of 10 inch hg in height.
20 8. Under any of the previously described tests, the water height shall remain constant,
21 after stabilization, for not less than 15 minutes without any further addition of water.
22
23 B. System Test. After the various sections of soil, waste and vent piping are installed, but before
24 fixtures are connected, test the system by:
25 1. Plugging outlets.
26 2. Filling vertical sections of multiple story buildings of not less than three floors at a
27 time with water. Provide wyes as required to facilitate plugging.
28 3. Test for 6 hours without any drop in the water level.
29

30 3.6 RODDING SEWERS
31

- 32 A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed
33 out after completion of construction and prior to finish floor being installed. All work must be
34 completed prior to substantial completion. All floor drains and cleanout locations must be
35 included in this work.
36
37 B. All sanitary soil and waste lines below building 3" and larger shall be internally videotaped at
38 time of substantial completion. All videotaping shall include on-screen date and time, and
39 include audio narration. All videotaping shall be provided by experienced individual in
40 videotaping piping systems. An Owner's Representative shall be present during video-taping.
41 Three copies of the videotape shall be delivered to the Owner for future records.
42
43 C. This work shall be done in the presence of the Owner's Representative, as part of the
44 Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be
45 removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to
46 clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.
47

48 3.7 SMOKE TESTING
49

- 50 A. Interior Plumbing Piping:
51 1. Contractor shall perform smoke testing on all interior sanitary sewer piping and
52 sanitary vent piping above and below floor prior to cover-up..
53 2. Artificially created smoke used must be a persistent white tracer smoke and
54 produced by thermogenic chemical reaction. All smoke candles or smoke pencils to
55 be used must be non-toxic and EPA approved. Provided by Superior Signal Smoke
56 Candles.

3. All plumbing fixtures must be installed including floor drains with wetted trap seals.
4. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
5. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
6. Typical findings from indoor smoke testing may include:
 - a. Dry traps in floor drains
 - b. Improperly capped sewer lines or vents
 - c. Broken sewer lines or vents
 - d. Cross connected sewer vents and drains
 - e. The drawing of air emanating from sewer vents into intakes of air exchange systems
 - f. Poorly glued pipe joints
 - g. Loose no-hub couplings
7. An Owner's Representative shall be present during smoke testing.

END OF SECTION

SECTION 22 14 13

ROOF DRAINAGE PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install roof drains, drain pipes and accessories.

1.2 RELATED WORK

- A. Division 22 Plumbing
1. Pipe and Pipe Fittings - General; for general piping requirements.
 2. Drains and Cleanouts.
 3. Plumbing Piping Insulation.
 4. Earthwork

1.3 REFERENCES

- A. CISPI – Cast Iron Soil Pipe Institute
- B. ASTM – American Society for Testing and Materials

PART 2 - PRODUCTS

2.0 ACCEPTABLE MANUFACTURERS

- A. Cast Iron Soil Pipe and Fittings
1. AB&I
 2. Charlotte Pipe and Foundry Co.
 3. Tyler Pipe / Soil Division

2.1 STORM PIPE AND FITTINGS

- A. Above Ground Pipe. Provide service weight cast iron Hub and Spigot soil pipe and fittings with compression type neoprene gaskets that conform to ASTM C-564. Pipe and fittings shall meet the requirements of ASTM A 74. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute.
- B. Below Slab on Grade: Provide Schedule 40 PVC plastic pipe and DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D 1784-82.
- C. Provide Fernco “Pro-Flex” shielded couplings, Series 3000 with one-piece neoprene gasket for cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 2” through 8” use Series 3000.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All above and below slab storm piping installation methods shall be in accordance with the Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers to be placed within 18” of hub or coupling. For large

ROOF DRAINAGE PIPING AND APPURTENANCES

diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".

- C. All above and below slab PVC storm piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards, and in accordance with ASTM D2321.

3.2 GRADE

- A. Give horizontal lines minimum grade of 1/8 inch per foot.

3.3 TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:

1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

- B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:

1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.4 RODDING SEWERS

- A. All storm sewer lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.
- B. All storm lines below building 3" and larger shall be internally video-taped at time of substantial completion. An Owner's Representative shall be present during video-taping. Three copies of the video-tape shall be delivered to the Owner for future records.
- C. This work shall be done in the presence of the Owner's Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall

1 be full size of pipe being cleaned for pipe sizes up to 6 inches. Pipe sizes 8 inches and larger
2 shall be hydro-flushed.
3

4 END OF SECTION

SECTION 22 20 00

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Earthwork
 2. Valves, Strainers and Vents
 3. Insulation
 4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
 1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
 2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
 3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
 1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
 2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.

3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
 4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
 5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
 6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
 2. 6" through 10" pipe size coupling housing minimum of 4" width.
 3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.
- G. Mechanical Joints. Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
 2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
 3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
 4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.
- H. Compression Joints for Cast Iron Water Pipe. Use Beltite, Tyton or Grip-Tite compression joints. Install in accordance with the manufacturer's recommendations for compression joints. Provide adequate concrete thrust blocks at changes of direction, as recommended by the manufacturer.
- I. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.
- J. Ring-Tite Joints: Ring-Tite gasketed sewer fittings for sanitary and storm. Furnish joints for installation manufactured per ASTM/CSA, Ipex, and J.M Eagle C900. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer. J.M Eagle pressure rated PVC water pipe. ASTM D2241 pressure rating, ASTM D3219 joints, gaskets ASTM F477.
- K. Ball Joints. Where shown, provide flexible ball joints, made of carbon steel. Ball joints must have 15° of angular flexibility. Use welded or flanged ends, as required. Furnish with 11N gaskets.
- L. Mechanically Formed Tee Fitting. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height not less than three (3) times the thickness of the branch wall. The branch tube shall be notched to conform with the inner curve of the run tube and shall have two (2) dimple / depth stops to insure that penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the

main line tube. Dimple depth stops shall be in line with the run tube. The second dimple shall be one quarter (1/4) inch above the first and shall serve as a visual point of observation. All joints shall be brazed with silver brazing alloy or Sil-Fos. Soft soldered joints shall not be allowed.

M. Press fittings for copper pipe 1/2" to 4": Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

N. Press fittings for steel pipe 1/2" to 2": Where accepted by local code for specific applications, Cold Press Mechanical Joint Fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing system shall be EPDM or HNBR as appropriate for a defined application. MegaPress system manufactured by VIEGA or approved equal and include "Smart Connect" assurance that unpressed fittings will not hold pressure. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.

1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of

America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.
- E. Press Connections: Copper and steel press fittings ½" through 4" shall be applied in accordance with the manufacturer's installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-"Pro-Press".

3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion.
- F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

- A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions,

1 walls, floors, etc.

2

3 3.10 ISOLATION VALVES

4

- 5 A. Provide piping systems with line size shutoff valves located at the risers, at main branch
6 connections to mains for equipment, to isolate central plant, and at other locations.

7

8 3.11 DRAIN VALVES

9

- 10 A. Install drain valves at low points of water piping systems so that these systems can be entirely
11 drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For
12 pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall
13 be plugged when not in use and at completion.

14

15 3.12 CLEANING OF PIPING SYSTEMS

16

- 17 A. General cleaning of piping systems. Purge pipe of construction debris and contamination
18 before placing the systems in service. Provide and install temporary connections as required
19 to clean, purge and circulate.

20

- 21 B. Install temporary strainers at the inlet of pumps and other equipment as necessary where
22 permanent strainers are not indicated. Keep strainers in service until the equipment has been
23 tested, then remove either entire strainer or straining element only. Fit strainers with a line
24 size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean
25 as frequently as necessary.

26

- 27 C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and
28 other deleterious substances without damage to system components. Open valves, drains,
29 vents and strainers at all system levels during flushing procedures. Flush until "potable water
30 clear" and particles larger than 5 microns are removed.

31

- 32 D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide
33 terminal drains in bottom of pipe end caps or blind flanges.

34

- 35 E. Dispose of water in approved manner.

36

- 37 F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to
38 any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering
39 flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not
40 removed by initial flushing. Flush system and replace with clean water.

41

- 42 G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and
43 particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve
44 body. Dispose of water in approved manner.

45

- 46 H. Submit status reports upon completion of each phase of work on each system.

47

48 3.13 TESTING

49

- 50 A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure
51 (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven
52 watertight.

53

- 54 B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

55

- 56 C. If any leaks or other defects are observed, suspend the test and correct the condition at once.

1 Repeat testing until leaks are eliminated and the full test period is achieved.

- 2
3 D. The satisfactory completion of testing does not relieve the Contractor of responsibility for
4 ultimate proper and satisfactory operation of piping systems and their accessories.
5

6 3.14 PIPE MARKERS
7

- 8 A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code
9 Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of
10 flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and
11 tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly
12 identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch
13 letters for 5-inch pipe and larger.
14

- 15 B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch
16 pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker
17 and direction of flow arrow tape; background colors of markers, arrows and type for each type
18 of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system.
19 Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and
20 larger.
21

- 22 C. Install identification in the following locations:
23 1. Both sides of penetrations through walls, floors and ceilings.
24 2. Close to valves or flanges.
25 3. Intervals on straight pipe runs not to exceed 50 feet
26 4. Apply marker where view is obstructed.
27

- 28 D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for
29 Identification of Piping Systems".
30

31 END OF SECTION

SECTION 22 33 33

ELECTRIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Domestic Water Piping.
 2. Plumbing Piping Insulation.
 3. Division 26 Electrical.

1.3 WARRANTY

- A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Rheem
- B. A. O. Smith

2.2 PRODUCTS

- A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.
- B. Provide an ASME code construction tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.
- C. Furnish factory-assembled, integral units equipped as follows:
 1. Immersion thermostat.
 2. High temperature limit switch (energy cutout).
 3. Low-water cutoff.
 4. Heavy duty UL rated for 100,000 cycles.
 5. Temperature and pressure relief valve.
 6. Anode rod.
- D. Provide heavy-duty, medium watt density elements having nicoloy sheathing and prewired leads.
- E. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish and shall enclose the tank with R-16 foam insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- 1
2 A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced
3 standards and conform to codes and ordinances of authorities having jurisdiction.
4
5 B. All installations shall be in accordance with the manufacturer's published recommendations.
6
7 C. Furnish all supports required by the equipment included in this Contract.
8
9 D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.
10
11 E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper
12 functioning and servicing of equipment.
13 1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each
14 heater.
15 2. Provide a temperature gauge in the domestic hot water piping within five feet of
16 outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be
17 easily readable from a standing position.
18
19 F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment,
20 such as dielectric coupling or dielectric flange fitting.
21
22 G. Route condensate to a vented receiver.
23
24 H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.
25
26 I. Set the operating and safety controls.
27
28 J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated
29 on Contract Drawings.
30
31 K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to
32 water heater as possible between water heater and all check valves or backflow preventers.
33 Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in
34 accordance with manufacturer's recommendations.
35
36 L. Install water heater in galvanized drain pan piped to floor drain. Elevate water heater tank
37 bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of
38 tank.
39

40 3.2 STARTUP
41

- 42 A. Startup shall be performed by factory trained and authorized personnel. The factory
43 representative shall also provide a technical and practical operation and maintenance training
44 seminar including a hands-on operation and maintenance demonstration, and classroom
45 presentation with handouts and visual aids, for no less than three physical plant personnel.
46
47

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

- A. Division 22 Plumbing
 1. Drains, Hydrants and Cleanouts.
 2. Domestic Water Piping.
 3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Plumbing Fixtures (Vitreous China):
 1. American Standard.
 2. Kohler.
- B. Plumbing Faucets:
 1. American Standard.
 2. Chicago.
 3. T&S Brass.
 4. Symmons
 5. Speakman
- C. Supports and Carriers:
 1. Wade
 2. Zurn
 3. J.R. Smith.
 4. Josam.
 5. Watts
 6. MIFAB
- D. Flush Valves:
 1. Sloan
 2. Zurn
- E. Supplies, Stops and Chrome Plated Tubular Brass:
 1. McGuire
 2. Chicago

PLUMBING FIXTURES AND FIXTURE CARRIERS

- 1 F. Water Closet Seats:
2 1. Beneke
3 2. Church
4 3. Olsonite
5 4. Bemis
6 5. Centoco
7
8 G. Electric Drinking Fountains:
9 1. Halsey Taylor
10 2. Elkay
11 3. Oasis
12 4. Haws
13
14 H. Floor Drains:
15 1. Wade
16 2. J.R. Smith
17 3. Josam
18 4. Zurn
19 5. Watts
20 6. MIFAB
21
22 I. Cleanouts:
23 1. Wade
24 2. J.R. Smith
25 3. Josam
26 4. Zurn
27 5. Watts
28 6. MIFAB
29
30 J. Shower Systems:
31 1. Bradley
32 2. Acorn
33 3. Symmons
34
35 K. Shower Valves
36 1. Chicago
37 2. Acorn
38 3. Symmons
39 4. Bradley
40
41 L. Stainless Steel Sinks:
42 1. Elkay
43 2. Just
44 3. Franke
45
46 M. Mop Sinks:
47 1. Crane Fiat
48 2. Stern Williams
49 3. Acorn
50
51 N. Service Sinks:
52 1. American Standard
53 2. Kohler
54 3. Eljer
55 4. CECO
56

- 1 O. Roof Drains:
2 1. Wade
3 2. J.R. Smith
4 3. Josam
5 4. Zurn
6 5. Watts
7 6. MIFAB
8
9 P. Thermostatic Mixing Valves
10 1. Lawler
11 2. Symmons
12 3. Leonard
13 4. Powers
14 5. Bradley
15
16 Q. Emergency Safety Equipment
17 1. Speakman
18 2. Bradley
19 3. Encon
20 4. Guardian
21 5. Haws
22
23 R. Shock Arrestors:
24 1. Precision Products
25 2. Sioux Chief
26
27 S. Backflow Preventors
28 1. Watts
29 2. Febco
30 3. Wilkins
31 4. Beeco
32
33 T. Hose Bibbs
34 1. Wade
35 2. Chicago
36 3. Josam
37 4. Woodford
38 5. Zurn
39 6. J.R. Smith
40 7. MIFAB
41
42 U. Wall Hydrants
43 1. Wade
44 2. Woodford
45 3. Zurn
46 4. J.R. Smith
47 5. Josam
48 6. MIFAB
49
50 V. Solids Interceptors
51 1. Wade
52 2. J.R. Smith
53 3. Zurn
54 4. Josam
55 5. MIFAB
56

1 2.2 REQUIREMENTS

- 2
3 A. Refer to the drawings for equipment to be supplied.
4

5 PART 3 - EXECUTION

6
7 3.1 INSTALLATION

- 8
9 A. Installation shall be in accordance with the manufacturer's instructions.
10
11 B. Make rough-in and final connection of service to each fixture provided under this Section and
12 other Sections or Architectural or Plumbing Drawings.
13
14 C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a
15 complete installation.
16
17 D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose
18 bibbs, and where shown on drawings.
19
20 E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
21
22 F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
23
24 G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
25
26 H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves
27 and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball
28 valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.
29
30 I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate
31 drains in mechanical equipment spaces to conform to drain locations of equipment furnished.
32 Coordinate drain location with food service equipment and Architectural Drawings.
33
34 J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel vandal
35 resistant screws.
36
37 K. Trap primer valves installed in concealed spaces shall have approved access doors for
38 accessibility.
39

40
END OF SECTION

SECTION 22 63 11

GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.
- B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.
- C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

- A. Division 22 Plumbing
 - 1. Plumbing Pipe and Fittings
 - 2. Valves and Vents

1.3 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
 - 1. Schedule 40 ASTM A 53 black steel pipe
 - 2. Factory fabricated socket weld fittings.
 - 3. Where exposed to the outdoors / on roof, cold press mechanical joint fittings shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements shall be HNBR and the fittings shall bear the CSA stamp to confirm acceptability for fuel gas systems. MegaPress system manufactured by VIEGA including "Smart Connect" to assure unpressed fittings will not hold pressure. Installers shall carry training credentials from the manufacturer to confirm they have been instructed in the correct installation procedures.
- B. Pipe Larger than 2 inch:
 - 1. Schedule 40 ASTM A 53 black steel pipe.
 - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
 - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
 - 2. Ground joint unions, with bronze seat.
 - 3. Flange joints for pipe larger than 2 inch in diameter.
- D. Flanges:
 - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

- 2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING
- A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.
- B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe.
- C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.3 PIPE AND FITTINGS - IN UTILITY TRENCH TO ISLAND LAB TABLES

- A. Pipe as specified in paragraph 2.1 above, run in utility trench similar to ABT, Inc., Polyduct Utility Trench, 39.2 inch long sections x 12 inches wide x 7 inches deep rectangular polymer concrete, non-sloping, flat bottom, solid cover steel floor plate bolted to unitized frame.

2.4 VALVES

- A. See Section 22 05 23.

2.5 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.
- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
 2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.

- 1 F. Weld all gas piping above grade.
- 2
- 3 G. Provide test ports and isolation valves to enable proper testing of system in the future.
- 4
- 5 H. Provide isolation valve and unions across regulators for proper removal.
- 6
- 7 I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above
- 8 grade.
- 9
- 10 J. Gas Pressure Regulators / Vents:
- 11 1. Piping shall be sized in accordance with the regulator manufacturer's instructions.
- 12 Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas
- 13 flow. Where there is more than one regulator at a location, each regulator shall have
- 14 a separate vent to the roof / outdoors. Headers with various installed devices can
- 15 cause regulator malfunction.
- 16 2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
- 17 3. Install vent piping from regulators to location to prevent gas smells from entering
- 18 building. Do not locate the vent line terminus near windows, fans, or other
- 19 ventilation equipment. See the installation instructions furnished with the regulator.
- 20 4. Install double elbows and insect screen at end of piping to prevent moisture and
- 21 insects from entering. Always point outdoor vent pipes in the downward position to
- 22 reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
- 23 5. When installed inside building route vents horizontally and terminate through
- 24 building sidewall. The vent must be piped to the outside atmosphere using the
- 25 shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large
- 26 as the vent size or larger. If a long gas run must be used, increase the pipe one
- 27 nominal size every ten feet to keep the flow restriction as low as possible. Vents
- 28 terminating through roof must have prior approval from Architect before installation.
- 29 Through roof penetrations shall be minimized.
- 30 6. Regulators installed outside or on roof top: Install regulator vent turned downward
- 31 with insect screen over vent opening. The vent shall be designed to prevent the entry
- 32 of water, insects, or other foreign materials that could cause blockage.
- 33 7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the
- 34 installer's responsibility to ensure the vent line is exhausting to a safe environment
- 35 8. Adhere to all applicable codes and regulations.
- 36

37 3.2 TESTING GAS PIPING

38

- 39 A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not
- 40 less than eight hours without noticeable drop.
- 41
- 42 B. Test joints with a soap solution while lines are under pressure.
- 43
- 44 C. Repair leaks.
- 45
- 46 D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a
- 47 minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty
- 48 (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten
- 49 (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be
- 50 observed for no less than (30) thirty minutes with no drop in pressure.
- 51
- 52 E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.
- 53
- 54 F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
- 55 1. To find form online, go to: Texas School Gas Test Form
- 56

57 3.3 IDENTIFICATION CONDUCTOR

- 1
2 A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping
3 system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
4
5 B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
6 1. Bolted gasketed cover with stainless steel screws.
7 2. Screw type terminal strip.
8 3. Legend on cover "gas pipe identification conductor."
9
10 C. Set in concrete pad.
11
12 3.4 PAINT EXPOSED OUTSIDE GAS PIPE
13
14 A. Interior and Exterior Gas piping shall be protected from rust.
15
16 B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand
17 tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal
18 Primer White and top coat of Yellow Alkyd Flat Enamel.
19
20

END OF SECTION

SECTION 23 01 00

HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations/equipment wiring diagrams.
 - 10. Schedule of filters for each item of equipment.
 - 11. Schedule of belts for each item of equipment.
 - 12. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit completed manuals in final electronic form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Electronic copies of complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
 - 3. Drawings:

- a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Control and flow diagrams.
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text, as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances that might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
 1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Summer and winter operating instructions.
 - 4) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Alignment, adjusting and checking.
 - 5) Routine service based on operating hours.
 - d. Servicing and lubrication schedule. List of lubricants required.
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Description of sequence of operation by control manufacturer.
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear.
 - 2) Items recommended to be stocked as spare parts.
 - h. As installed control diagrams by controls manufacturer.
 - i. Complete equipment internal wiring diagrams.
 - j. Schedule of filters for each air handling system.
 - k. Schedule of belts for each item of equipment.
 - l. Each Contractor's coordination drawings.
 - m. As installed color coded piping diagrams.
 - n. Charts of valve tag number, with location and function of each valve.
 - o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - p. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 23.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.
 9. Provide extended compressor warranty certificates.
- END OF SECTION

SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.

B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Mechanical work shall comply with applicable inspection services:

1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- 1 A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of
2 various elements of work. Determine exact locations from field measurements.
3
- 4 1.6 PROJECT RECORD DOCUMENTS
5
- 6 A. Maintain at the job site a separate set of white prints (black line) of the contract drawings
7 for the sole purpose of recording the "as-built" changes and diagrams of those portions of
8 work in which actual construction is at variance with the contract drawings. Mark the
9 drawings with a colored pencil. Prepare, as the work progresses and upon completion of
10 work, reproducible drawings clearly indicating locations of various lines, valves,
11 ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line
12 elevation of sewer lines. Record existing and new underground and under slab piping
13 with dimensioned locations and elevations of such piping.
14
- 15 B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the
16 original drawings and transfer as-built changes to these. Prior to transmittal of corrected
17 drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether
18 corrections were necessary and include in the transmittal (2 sets are for the Owner's use
19 and one set is for the Architect/Engineer's records). Delivery of these as-built prints and
20 reproducible drawings is a condition of final acceptance. Provide record drawings on one set each
21 (reproducible Dayrex mylar film positives) and AutoCad 2014 / Revit CAD files on disk
22 (CD Rom).
23
- 24 C. As-Built drawings should indicate the following information as a minimum:
25 1. Indicate all addendum changes to documents.
26 2. Remove Engineer's seal, name, address and logo from drawings.
27 3. Mark documents RECORD DRAWINGS.
28 4. Clearly indicate: DOCUMENT PRODUCED BY
29 5. Indicate all changes to construction during construction. Indicate actual routing
30 of all piping, ductwork, etc. that were deviated from construction drawings.
31 6. Indicate exact location of all underground mechanical piping and elevation.
32 7. Indicate exact location of all underground electrical raceways and elevations.
33 8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
34 9. Location and size of all ductwork and mechanical piping above ceiling including
35 exact location of isolation of domestic and mechanical valves.
36 10. Exact location of all electrical equipment in and outside of the building.
37 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
38 12. Cloud all changes.
39
- 40 1.7 SPACE REQUIREMENTS
41
- 42 A. Consider space limitations imposed by contiguous work in selection and location of
43 equipment and material. Do not provide equipment or material that is not suitable in this
44 respect.
45
- 46 1.8 RELATION WITH OTHER TRADES
47
- 48 A. Carefully study all matters and conditions concerning the project. Submit notification of
49 conflict in ample time to prevent unwarranted changes in any work. Review other
50 Divisions of these specifications to determine their requirements.
51
- 52 B. Because of the complicated relationship of this work to the total project, conscientiously
53 study the relation and cooperate as necessary to accomplish the full intent of the
54 documents.
55
- 56 C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open

ends of pipe before any concrete is placed. Furnish sizes of required equipment pads.
Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in

equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.3 LUBRICATION, REFRIGERANT AND OIL

- A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.
- B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.
- C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
 - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
 - 2. Chamfer strips at edges and corner of forms.
 - 3. Smooth steel trowel finish.
 - 4. Doweled to existing slab

- 1
- 2 D. Install concrete curbs around duct penetrations or multiple pipe penetrations.
- 3
- 4 3.5 INSTRUCTION OF OWNER'S PERSONNEL
- 5
- 6 A. Prior to final inspection, conduct an on-site training program to instruct the Owner's
- 7 operating personnel in the operation and maintenance of the mechanical systems.
- 8 1. Provide the training during the Owner's regular working day.
- 9 2. The Instructors shall each be experienced in their phase of operation and
- 10 maintenance of building mechanical systems and with the project.
- 11
- 12 B. Time to be allocated for instructions.
- 13 1. Minimum of 40 hours dedicated instructor time.
- 14 2. 8 hours on each of 5 days.
- 15
- 16 C. Before proceeding with the on-site training program, submit the program syllabus;
- 17 proposed time and dates; and other pertinent information for review and approval.
- 18 1. One copy to the Owner.
- 19 2. One copy to the Architect/Engineer.
- 20
- 21 D. The Owner will provide a list of personnel to receive instructions, and will coordinate
- 22 their attendance at the agreed upon times.
- 23
- 24 E. Use the operation and maintenance manuals as the basis of instruction. Review contents
- 25 of manual with personnel in detail to explain all aspects of operation and maintenance.
- 26
- 27 F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing,
- 28 maintenance, and shut down of each item of equipment.
- 29
- 30 G. Demonstrate equipment functions (both individually and as part of the total integrated
- 31 system).
- 32
- 33 H. Prepare and insert additional data in the operating and maintenance manuals when the
- 34 need for additional data becomes apparent during instructions.
- 35
- 36 I. Submit a report within one week after completion of the training program that
- 37 instructions have been satisfactorily completed. Give time and date of each
- 38 demonstration and hours devoted to the demonstration, with a list of people present.
- 39
- 40 J. At the conclusion of the on-site training program, have the person designated by the
- 41 Owner sign a certificate to certify that he/she has a proper understanding of the system,
- 42 that the demonstrations and instructions have been satisfactorily completed, and the scope
- 43 and content of the operating and maintenance manuals used for the training program are
- 44 satisfactory.
- 45
- 46 K. Provide a copy of the report and the certificate in an appropriately tabbed section of each
- 47 Operating and Maintenance Manual.
- 48
- 49 3.6 EQUIPMENT IDENTIFICATION
- 50
- 51 A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
- 52 1. Designation approved by Architect/Engineer.
- 53 2. Equipment includes, but is not limited to, air handling units, fan coil units,
- 54 variable volume boxes, fans, pumps, boilers and chillers.
- 55 3. Submit schedule of equipment to be included and designations.
- 56

- 1 B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.
- 2
- 3 3.7 OBSTRUCTIONS
- 4
- 5 A. The drawings indicate certain information pertaining to surface and subsurface
- 6 obstructions which has been taken from available drawings. Such information is not
- 7 guaranteed, however, as to accuracy of location or complete information.
- 8 1. Before any cutting or trenching operations are begun, verify with Owner's
- 9 representative, utility companies, municipalities, and other interested parties that
- 10 all available information has been provided.
- 11 2. Should obstruction be encountered, whether shown or not, alter routing of new
- 12 work, reroute existing lines, remove obstruction where permitted, or otherwise
- 13 perform whatever work is necessary to satisfy the purpose of the new work and
- 14 leave existing services and structures in a satisfactory and serviceable condition.
- 15
- 16 B. Assume total responsibility for and repair any damage to existing utilities or construction,
- 17 whether or not such existing facilities are shown.
- 18
- 19 3.8 PROTECTION
- 20
- 21 A. Protect work, equipment, fixtures, and materials. At work completion, work must be
- 22 clean and in original manufacturer's condition.
- 23
- 24 3.9 INDOOR AIR QUALITY
- 25
- 26 A. All equipment and ductwork shall be installed to allow sufficient space for testing,
- 27 maintenance, and commissioning functions. Access doors or panels shall be installed in
- 28 ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of
- 29 outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and
- 30 fans.
- 31
- 32 B. Practice source control and eliminate potential contaminants in material selection,
- 33 installation, and maintenance.
- 34
- 35 C. Provide installation and disposal instructions for all materials and chemicals that are
- 36 potential contaminants.
- 37
- 38 D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in
- 39 the use of materials.
- 40
- 41 E. Utilize manufacturer's recommendations and provide installation instructions for all
- 42 chemicals, compounds, and potential contaminants including pre-installation degassing if
- 43 required.
- 44
- 45 F. Ventilate completed building prior to final completion using no less than design outside
- 46 air for at least 48 hours before occupancy.
- 47
- 48 G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air
- 49 distribution system.
- 50
- 51 H. Steps shall be taken to ensure that the HVAC system continues to function effectively
- 52 and are not damaged or contaminated during construction activities.
- 53
- 54

END OF SECTION

SECTION 23 05 10

HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK-UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock-up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
 - 1. Rough-in.
 - 2. Finish with all appurtenances in place.
 - 3. Insulation installed.
 - 4. Demonstrations.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 FAN/COIL UNITS (WATER SOURCE HEAT PUMPS)

- A. Mock-up a fan/coil unit (water source heat pump) completely installed, including:
 - 1. Primary, secondary and auxiliary drain pans.
 - 2. Piping connections; including all piping appurtenances.
 - 3. Pipe insulation.
 - 4. Condensate drain piping.
 - 5. Electrical connections.
 - 6. Duct connection beyond first transition.
 - 7. Block valves, balancing valves, and control valves.
 - 8. Cabinet/internal vibration isolation.
 - 9. Suspension system.
- B. Tests: Air flow at scheduled static pressure.
- C. Demonstrate:
 - 1. Filter accessibility.
 - 2. Accessibility to drain and components for service.
 - 3. Controls sequence.

3.2 AIR HANDLING UNIT

- A. Mock-up an air handling unit, completely installed, including:
 - 1. Piping connections; including thermowells, test stations, test wells and other piping appurtenances.
 - 2. Pipe insulation.
 - 3. Condensate drain piping.
 - 4. Electrical connections.
 - 5. Ductwork beyond the first transition.
 - 6. Control valves and bypass.
 - 7. Cabinet/internal vibration isolation.

8. Block valves and balancing valves.
9. Duct insulation.
10. Instrumentation.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:

1. Filter accessibility.
2. Accessibility to drain and components for service.
3. Controls sequence.

3.3 CONSTANT VOLUME TERMINAL BOX

A. Mock-up a Constant Volume Terminal Box completely installed, including:

1. Piping connections, including all piping appurtenances.
2. Pipe insulation.
3. Electrical connections.
4. Duct connection beyond first transition.
5. Block valves, balancing valves, and control valves.
6. Cabinet/internal vibration isolation.
7. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:

1. Control Sequence.
2. Accessibility to components for service.

3.4 HOT AND CHILLED WATER CIRCULATING PUMPS

A. Mock-up one each system pump, completely installed including:

1. Pump mounted on housekeeping pad.
2. Auxiliary drain pan. (Chilled water only)
3. Piping to a point beyond the complete valve and instrumentation assemblies.
4. Strainers with blowdown.
5. Flexible piping connection.
6. Pipe supports.
7. Pipe insulation.
8. Pump painting.
9. Electrical connections.

3.5 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 23 05 12

HVAC SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by these specifications as outlined below.
- B. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- C. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: $\frac{1}{4}'' = 1'-0''$.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
 - 1. Actual mechanical equipment and components to be furnished
 - 2. Service clearance
 - 3. Relationship to other equipment and components
 - 4. Roof drains and leader piping
 - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:

- 1 begin work scheduled to have submittals reviewed until return of reviewed submittals
2 with Architect / Engineer's acceptance.
3
- 4 F. Contractor's responsibility for errors and omissions in submittals is not relieved whether
5 Architect / Engineer reviews submittals or not.
6
- 7 G. Contractor's responsibility for deviations in submittals from requirements of Contract
8 Documents is not relieved whether Architect/Engineer reviews submittals or not, unless
9 Architect / Engineer gives written acceptance of the specific deviations on reviewed
10 documents.
11
- 12 H. Submittals shall show sufficient data to indicate complete compliance with Contract
13 Documents:
14 1. Proper sizes and capacities
15 2. That the item will fit in the available space in a manner that will allow proper
16 service
17 3. Construction methods, materials and finishes
18
- 19 I. Schedule submissions at least 15 days before date reviewed submittals will be needed.
20
- 21 1.7 SUBMISSION REQUIREMENTS
22
- 23 A. Make submittals promptly in accordance with approved schedule, and in such sequence
24 as to cause no delay in the Project or in the work of any other Contractor.
25
- 26 B. Number of submittals required:
27 1. Shop Drawings and Coordination Drawings: Submit one reproducible
28 transparency and three opaque reproductions.
29 2. Product Data: Submit the number of copies which the contractor requires, plus
30 those which will be retained by the Architect/Engineer.
31
- 32 C. Accompany submittals with transmittal letter, in duplicate, containing:
33 1. Date
34 2. Project title and number
35 3. Contractor's name, address and contact number.
36 4. The number of each Shop Drawing, Project Datum and Sample submitted
37 5. Other pertinent data
38
- 39 D. Submittals shall include:
40 1. The date of submission
41 2. The project title and number
42 3. Contract Identification
43 4. The names of:
44 a. Contractor
45 b. Subcontractor
46 c. Supplier
47 d. Manufacturer
48 5. Identification of the product
49 6. Field dimensions, clearly identified as such
50 7. Relation to adjacent or critical features of the work or materials
51 8. Applicable standards, such as ASTM or federal specifications numbers
52 9. Identification of deviations from contract documents
53 10. Suitable blank space for General Contractor and Architect/Engineer stamps
54 11. Contractor's signed and dated Stamp of Approval
55

- 1 E. Coordinate submittals into logical groupings to facilitate interrelation of the several
2 items:
3 1. Finishes which involve Architect/Engineer selection of colors, textures or
4 patterns
5 2. Associated items which require correlation for efficient function or for
6 installation
7
- 8 1.8 SUBMITTAL SPECIFICATION INFORMATION
9
- 10 A. Every submittal document shall bear the following information as used in the project
11 manual:
12 1. The related specification section number
13 2. The exact specification section title
14
- 15 B. Submittals delivered to the Architect/Engineer without the specified information will not
16 be processed. The Contractor shall bear the risk of all delays, as if no submittal had been
17 delivered.
18
- 19 1.9 RESUBMISSION REQUIREMENTS
20
- 21 A. Make re-submittals under procedures specified for initial submittals.
22 1. Indicate that the document or sample is a re-submittal
23 2. Identify changes made since previous submittals
24
- 25 B. Indicate any changes which have been made, other than those requested by the Architect /
26 Engineer.
27
- 28 1.10 CONTRACTOR'S STAMP OF APPROVAL
29
- 30 A. Contractor shall stamp and sign each document certifying to the review of products, field
31 measurements and field construction criteria, and coordination of the information within
32 the submittal with requirements of the work and of Contract Documents.
33
- 34 B. Contractor's stamp of approval on any submittal shall constitute a representation to
35 Owner and Architect/Engineer that Contractor has either determined and verified all
36 quantities, dimensions, field construction criteria, materials, catalog numbers, and similar
37 data or assumes full responsibility for doing so, and that Contractor has reviewed or
38 coordinated each submittal with the requirements of the work and the Contract
39 Documents.
40
- 41 C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's
42 stamp of approval and signature.
43
- 44 D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval
45 and signature will not be processed. The Contractor shall bear the risk of all delays, as if
46 no submittal had been delivered.
47
- 48 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS
49
- 50 A. The Architect / Engineer will:
51 1. Review identified submittals with reasonable promptness and in accordance
52 with schedule
53 2. Affix stamp and initials or signature, and indicate requirements for re-submittal
54 or approval of submittal
55 3. Return submittals to Contractor for distribution or for resubmission
56

- 1 B. Review and approval of submittals will not extend to design data reflected in submittals
2 which is peculiarly within the special expertise of the Contractor or any party dealing
3 directly with the Contractor.
4
- 5 C. Architect / Engineer's review and approval is only for conformance with the design
6 concept of the project and for compliance with the information given in the contract.
7 1. The review shall not extend to means, methods, sequences, techniques or
8 procedures of construction or to safety precautions or programs incident thereto.
9 2. The review shall not extend to review of quantities, dimensions, weights or
10 gauges, fabrication processes or coordination with the work of other trades.
11
- 12 D. The review and approval of a separate item as such will not indicate approval of the
13 assembly in which the item functions.
14

15 1.12 SUBSTITUTIONS

- 16
- 17 A. Do not make requests for substitution employing the procedures of this Section.
18
- 19 B. The procedure for making a formal request for substitution is specified in Div. 1.
20

21 PART 2 - PRODUCTS - NOT USED

22

23 PART 3 - EXECUTION - NOT USED

24

25 END OF SECTION

SECTION 23 05 13

ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
 - 1. Motors for mechanical equipment.
 - 2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
 - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
 - 5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
 - 6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
 - 7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
 - 8. Pipe heat tracing.
 - 9. Cooling tower vibration switch/interlock/reset.
 - 10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
 - 11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
 - 12. Wiring of all related circulating water system chemical treatment devices.
 - a. Low voltage electric contacting water meter
 - b. Solenoid valve/blow-down assembly
 - 13. Radiant heater timer switches and/or thermostats
 - 14. Low Voltage thermostat wiring
- C. Refer to Division 23 Controls Sections for related control system wiring.
- D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.
- E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.
- F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- 1 A. Wherever possible, match elements of electrical provisions of mechanical work with
2 similar elements of electrical work specified in Division 26 sections for electrical work
3 not otherwise specified.
4
- 5 B. For electrical equipment and products, comply with applicable NEMA standards, and
6 refer to NEMA standards for definitions of terminology. Comply with National Electrical
7 Code (NFPA 70) for workmanship and installation requirements.
8
- 9 1.4 SUBMITTALS
- 10
- 11 A. Include in listing of motors, voltage, notation of whether motor starter is furnished or
12 installed integrally with motor or equipment containing motors.
13
- 14 PART 2 - PRODUCTS
- 15
- 16 2.1 MOTORS
- 17
- 18 A. Provide motors for mechanical equipment manufactured by one of the following:
19 1. Baldor Electric Company.
20 2. Century Electric Div., Inc.
21 3. General Electric Co.
22 4. Louis Allis Div.; Litton Industrial Products, Inc.
23 5. Lincoln Electric
24 6. Marathon Electric Mfg. Corp.
25 7. Reliance Electric Co.
26 8. Westinghouse Electric Corp.
27 9. WEG
28
- 29 B. Motor Characteristics. Except where more stringent requirements are indicated, and
30 except where required items of mechanical equipment cannot be obtained with fully
31 complying motors, comply with the following requirements for motors of mechanical
32 work:
33
- 34 C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C
35 temperature rise for continuous duty at full load (Class A Insulation).
36
- 37 D. Provide each motor capable of making starts as frequently as indicated by automatic
38 control system, and not less than 5 starts per hour for manually controlled motors.
39
- 40 E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for
41 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller,
42 except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type.
43 Coordinate current characteristics with power specified in Division 26 sections, and with
44 individual equipment requirements specified in other Division 23 requirements. For 2-
45 speed motors provide 2 separate windings on polyphase motors. Do not purchase motors
46 until power characteristics available at locations of motors have been confirmed, and
47 until rotation directions have been confirmed.
48
- 49 F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
50
- 51 G. Motor Construction. Provide general purpose, continuous duty motors, Design "B"
52 except "C" where required for high starting torque.
53 1. Frames. NEMA #56.
54 2. Bearings are to be ball or roller bearings with inner and outer shaft seals,
55 regreasable except permanently sealed where motor is inaccessible for regular
56 maintenance. Where belt drives and other drives produce lateral or axial thrust
57 in motor, provide bearings designed to resist thrust loading. Refer to individual

- 1 section of Division 23 for fractional-hp light-duty motors where sleeve-type
2 bearings are permitted.
- 3 3. Except as indicated, provide open drip-proof motors for indoor use where
4 satisfactorily housed or remotely located during operation, and provide guarded
5 drip-proof motors where exposed to contact by employees or building
6 occupants. Provide weather-protected Type I for outdoor use, Type II where not
7 housed. Refer to individual sections of Division 23 for other enclosure
8 requirements.
- 9 4. Provide built-in thermal overload protection and, where indicated, provide
10 internal sensing device suitable for signaling and stopping motor at starter.
- 11 5. Noise Rating: Provide "Quiet" rating on motors.

12

13 H. All motors shall be premium efficiency.

14

15 I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.

16

17 2.2 EQUIPMENT FABRICATION

- 18
- 19 A. Fabricate mechanical equipment for secure mounting of motors and other electrical items
20 included in work. Provide either permanent alignment of motors with equipment, or
21 adjustable mountings as applicable for belt drives, gear drives, special couplings and
22 similar indirect coupling of equipment. Provide safe, secure, durable, and removable
23 guards for motor drives. Arrange for lubrication and similar running-maintenance without
24 removal of guards.

25

26 2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

- 27
- 28 A. All motors operated on variable frequency drives shall be equipped with a maintenance-
29 free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3
30 requirements, with a minimum of two rows of circumferential microfibers to discharge
31 damaging shaft voltages away from the bearings to ground. SGR's Service Life:
32 Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber
33 Shaft Grounding Ring, or approved equal.
- 34
- 35 B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring
36 installed on either the drive end or non-drive end. Motors over 100 HP shall be provided
37 with an insulated bearing on the non-drive end and a shaft grounding ring on the drive
38 end of the motor with the exception of line contact bearings in the drive end of the
39 machine. In this instance the line contact bearing must be electrically insulated and the
40 AEGIS Bearing Protection Ring installed on the opposite drive end of the motor.
41 Grounding rings shall be provided and installed by the motor manufacturer's
42 recommendations.

43

44 PART 3 - EXECUTION

45

46 3.1 INSTALLATION

- 47
- 48 A. Install motors on motor mounting systems in accordance with motor manufacturer's
49 instructions, anchored to resist torque, drive thrusts, and other external forces inherent in
50 mechanical work. Secure sheaves and other drive units to motor shafts with keys and
51 Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts
52 parallel with machine shafts.
- 53
- 54 B. Verify voltage with Electrical Plans.

55

56 END OF SECTION

SECTION 23 05 14

HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

- A. Division 23 - Mechanical
 - 1. Insulation
 - 2. Fan/Coil Units
 - 3. Single Package Rooftop Air Conditioners
 - 6. Equipment Drain Pans

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the system to facilitate easy removal.
 - 1. Use threaded plugged tee at each change of direction to permit cleaning.
 - 2. Install a cleanout every 50 feet of straight run piping
 - 3. Maintain a positive slope on all piping
- B. Install a water seal trap leg based on the fan pressure.
 - 1. Size the length of the trap leg 1 inch larger than the actual system pressure.
- C. Install traps and cleanout as shown in the drawing details.
 - 1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

- A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

- A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION

SECTION 23 05 17

HVAC ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Automatic closing and latching mechanism
- F. Prime coat finish
- G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- | | | |
|---|----|--------|
| 1 | A. | Milcor |
| 2 | | |
| 3 | B. | MIFAB |
| 4 | | |
| 5 | C. | Acudor |
| 6 | | |
| 7 | D. | Elmdor |

PART 3 - EXECUTION

3.1 INSTALLATION

- 13 A. Access doors specified in Division 23 will be installed by other crafts. Not all required
14 access doors are shown. Coordinate with the Contractor to locate access doors for ease of
15 operation and maintenance of concealed equipment.
- 16
- 17 B. Installation shall be in accordance with the manufacturer's printed instructions.
- 18
- 19 C. Minimum size required:
- 20 1. 36" x 24" for Mechanical HVAC equipment related items
- 21 2. 18" x 18" for electrical related items

END OF SECTION

SECTION 23 05 48

VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

- A. Division 23 Mechanical.

1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

- A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amber Booth
- B. Kinetics
- C. Mason
- D. Korfund
- E. VSI
- F. Vibration Eliminator Co., Inc.
- G. Metraflex

2.2 ISOLATOR TYPES

- A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.
- B. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Condensing Units	A	0.35"
Ground Mounted Packaged AC Units	A	0.35"
In-Line Fans	B	0.5"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.
- B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION

SECTION 23 05 93

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Balance, adjust and test the air distribution system including the exhaust system.
- B. Balance, adjust and test the hydronic system.
- C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

- A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

- A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

- A. History of the TAB organization.
- B. Agency certification.
- C. Personnel qualifications.
- D. TAB data forms.
- E. Instrumentation list.
- F. Name of the project supervising engineer.
- G. Name and address and contact person of five successfully completed projects of similar size and scope.
- H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

- A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
- B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.
- C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
- D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession

of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.

E. The balancing agency shall have operated for a minimum of five years under its current name.

F. Personnel:

1. The project supervisor shall be a Professional Engineer registered in Texas.
 - a. Extensive knowledge of the work involved.
 - b. At least five years experience conducting tests of the type specified.
 - c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
2. All work shall be conducted under the direct supervision of the supervising engineer.
3. Technicians shall be trained and experienced in the work they conduct.

1.6 WARRANTY

A. Provide (AABC) guarantee in writing.

B. Extended warranty.

1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TAB TOLERANCES

A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.2 SITE VISITS

A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.

B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.

- 1
- 2 C. Note proper piping installation, location of valves, and flow measuring instruments.
- 3
- 4 D. Make one series of visits, phased as required by construction progress, prior to
- 5 installation of the ceiling. Note proper installation of balancing dampers.
- 6
- 7 E. Continue the site visits up to completion of project. In each succeeding report, list
- 8 corrections made from previous reports.
- 9
- 10 3.3 TESTING INSTRUMENTS
- 11
- 12 A. Submit a list of all instruments to be used for the test and balance procedures.
- 13 1. Catalog sheets
- 14 2. Certificate of last calibration
- 15 3. Calibration within a period of six months prior to balancing
- 16
- 17 B. Testing equipment shall be in good working order and tested for accuracy prior to start of
- 18 work.
- 19
- 20 3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS
- 21
- 22 A. Review the related ductwork shop drawings and piping shop drawings. Make
- 23 recommendations concerning suitability with respect to the testing, balancing and
- 24 adjusting work.
- 25
- 26 B. Make tests to verify proper placement of the static pressure sensors for the variable air
- 27 volume fan system control.
- 28
- 29 C. In cooperation with the work specified in Building Management and Control System
- 30 section, a systematic listing of the testing and verification shall be included in the final
- 31 TAB report. The TAB firm shall provide a laptop computer to operate with the Building
- 32 Management and Control System. Building Management and Control System shall
- 33 provide all necessary software and special interface cables, as required, to communicate
- 34 with the DDC system:
- 35 1. Work with the temperature control contractor to ensure the most effective total
- 36 system operation within the design limitations, and to obtain mutual
- 37 understanding of the intended control performance.
- 38 2. Verify that all control devices are properly connected.
- 39 3. Verify that all dampers, valves, and other controlled devices, are operated by the
- 40 intended controller.
- 41 4. Verify that all dampers and valves are in the position indicated by the controller
- 42 (open, closed or modulating).
- 43 5. Verify the integrity of valves and dampers in terms of tightness of close-off and
- 44 full open positions. This includes dampers in multizone units, terminal boxes
- 45 and fire/smoke dampers.
- 46 6. Observe that all valves are properly installed in piping system in relation to
- 47 direction of flow and location.
- 48 7. Observe the calibration of all controllers.
- 49 8. Verify the proper application of all normally opened and normally closed valves.
- 50 9. Observe the locations of all thermostats and humidistats for potential erratic
- 51 operation from outside influences such as sunlight, drafts or cold walls.
- 52 10. Observe the location of all sensors to determine whether their position will allow
- 53 them to sense only the intended temperatures or pressures of the media. Control
- 54 contractor will relocate as deemed necessary by the Engineer.
- 55 11. Verify that the sequence of operation for any control mode is in accordance with
- 56 the approved shop drawings and specifications. Verify that no simultaneous

- 1 heating and cooling occurs.
- 2 12. Verify the correct operation of all interlock systems and installation is per the
- 3 manufacturer recommendations.
- 4 13. Check all dampers for free operation.
- 5 14. Verify that all controller setpoints meet the design intent.
- 6 15. Perform variable volume system verification to assure the system and its
- 7 components track with changes from full flow to minimum flow.
- 8
- 9 D. Upon completion of the testing and balancing, submit three days prior notice that the
- 10 systems are ready for a running test. A qualified representative of the test and balance
- 11 organization shall be present, with a representative from the engineers office, to field
- 12 verify TAB report readings. Specific and random selections of data recorded in the
- 13 certified test and balance report will be reviewed.
- 14
- 15 3.5 INSTRUMENT TEST HOLES
- 16
- 17 A. When it is required to make holes in the field to measure temperature, static pressure or
- 18 velocity in the ducts:
- 19 1. Drill holes, plug and tape external duct insulation.
- 20 2. Repair damaged insulation to Engineer's approval.
- 21
- 22 3.6 TESTING THE AIR DISTRIBUTION SYSTEM
- 23
- 24 A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers
- 25 have been installed per design and set full open. The TAB agency shall perform the
- 26 following TAB procedures in accordance with the AABC National Standards and all
- 27 results shall be recorded in the TAB report:
- 28 1. Supply Fans:
- 29 a. Fan speeds: Test and adjust fan RPM to achieve design CFM
- 30 requirements.
- 31 b. Current and Voltage: Test and record motor voltage and amperage, and
- 32 compare data with the nameplate limits to ensure fan motor is not in or
- 33 above the service factor.
- 34 c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply
- 35 and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube
- 36 traverse is not practical, an explanation of why a traverse was not made
- 37 must appear on the appropriate data sheet. Measurements must be
- 38 recorded with an Inclined Manometer or an Inclined/Vertical
- 39 Manometer.
- 40 d. Outside Air: Test and adjust the outside air on applicable equipment
- 41 using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an
- 42 explanation of why a traverse was not made must appear on the
- 43 appropriate data sheet. If a traverse is not practical, use the mixed air
- 44 temperature method, if the inside and outside temperature difference is
- 45 at least 20°F, or use the difference between Pitot-tube traverse of the
- 46 supply and return ducts.
- 47 e. Static Pressure: Test and record system static pressure, including the
- 48 static pressure profile of each supply fan.
- 49 2. All Other Fans:
- 50 a. Fan speeds: Test and adjust fan RPM to achieve design CFM
- 51 requirements.
- 52 b. Current and Voltage: Test and record motor voltage and amperage, and
- 53 compare data with the nameplate limits to ensure fan motor is not in or
- 54 above the service factor.
- 55 c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return
- 56 ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not

- 1 practical, an explanation of why a traverse was not made must appear
2 on the appropriate data sheet. Measurements must be recorded with an
3 Inclined Manometer or an Inclined/Vertical Manometer.
- 4 d. Static Pressure: Test and record system static pressure, including the
5 static pressure profile of each return fan.
- 6 3. VAV Terminal Units:
- 7 a. Set and record volume regulators on all terminal boxes to meet design
8 maximum and minimum CFM requirements.
- 9 b. Identification: Identify the type, location, and size of each terminal unit.
10 This information must be recorded on the terminal box data sheets.
- 11 4. Diffusers, Registers and Grilles:
- 12 a. Tolerances: Test, adjust, and balance each diffuser, grille, and register
13 to within 5% of design requirements. Minimize drafts. Observe throws
14 are in direction as indicated on drawings.
- 15 5. Coils (including electric coils):
- 16 a. Air Temperature: Once air flows are set to acceptable limits, take wet
17 bulb (cooling coil only) and dry bulb air temperatures on the entering
18 and leaving side of each coil. Calculate the sensible and latent (cooling
19 coil only) capacity of the coil. Provide information in TAB report.
- 20
- 21 B. Record preliminary air handler data, including fan RPM and static pressures across filter,
22 fans and coils.
- 23
- 24 C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined
25 manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply
26 and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not
27 practical, a detailed explanation of why a traverse was not made must appear on the
28 appropriate data sheet.
- 29
- 30 D. Where air measuring stations are installed, use pitot tube traverse readings to verify and
31 record the correct calibration of the stations output.
- 32
- 33 E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply
34 air, return air, and outside air.
- 35
- 36 F. Measure and adjust all supply and return branches to design air delivery.
- 37
- 38 G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.
- 39
- 40 H. Make a set of recordings showing final system conditions.
- 41

42 3.7 TESTING THE HYDRONIC SYSTEMS

43

- 44 A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and
45 coils have been filled and purged; that strainers have been cleaned; that water has been
46 flushed and is in a clean condition, and that all balancing valves (except bypass valves)
47 are set full open. As applicable, check air vents and expansion or compression tank for
48 proper operation. The TAB agency shall perform the following testing and balancing
49 functions in accordance with the AABC National Standards and all results shall be
50 recorded in the TAB report:
- 51 1. Record preliminary pump data.
- 52 a. Pump RPM.
- 53 b. Pump shut-off differential head.
- 54 c. Pump operating differential head.
- 55 d. Check and verify pump alignment.
- 56 e. Verify impeller diameter.

- 1
- 2 B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as
- 3 read from the manufacturer's pump curve and from a flow meter.
- 4
- 5 C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm,
- 6 not the total of all the valves. Determine the diversity of the system and balance the
- 7 individual coils with the maximum pump water quantity flowing in the system.
- 8
- 9 D. Balance flow through:
- 10 1. Chillers.
- 11 2. Coils.
- 12 3. Boiler.
- 13 4. Pumps
- 14 5. Condensers.
- 15 6. Cooling tower.
- 16 7. Heat Exchanger.
- 17
- 18 E. Use flow meters, differential pressures and temperature relationships as required.
- 19
- 20 F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full
- 21 flow through the coil including the valve.
- 22
- 23 G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings
- 24 showing final systems conditions.
- 25
- 26 H. Pumps:
- 27 1. Test and adjust pumps to meet design water flow requirements. Check pumps
- 28 for proper operation. Pumps shall be free of vibration and cavitation Record
- 29 appropriate gauge readings for final TDH and Block-Off/Dead head
- 30 calculations. Check and verify pump alignment.
- 31 2. Current and Voltage: Test and record motor voltage and amperage, and compare
- 32 data with the nameplate limits to ensure pump motor is not in or above the
- 33 service factor.
- 34
- 35 I. Coils:
- 36 1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within
- 37 5% of design flow requirements.
- 38 2. Verification: Verify the type, location, final pressure drop and water quantity
- 39 (GPM) of each coil. Calculate the actual capacity of all coils. This information
- 40 shall be recorded on coil data sheets.
- 41
- 42 J. Boilers:
- 43 1. Verify that boilers have been filled and started by others, and are in operation.
- 44 2. Current and Voltage: As applicable, test and record motor voltage and
- 45 amperage, and compare data with the nameplate limits to ensure motor is not in
- 46 or above the service factor.
- 47 3. Test, adjust and record water flows through water boilers.
- 48 4. Test and record water temperature profiles of each boiler.
- 49
- 50 K. Chillers:
- 51 1. Verify that chillers have been started by the manufacture and are in operation.
- 52 Test and adjust chiller water flows to within 5% of the design requirements by
- 53 using a U-TUBE manometer and setting balancing valves.
- 54 2. Current and Voltage: Test and record motor voltage and amperage, and compare
- 55 data with the nameplate limits to ensure compressor motor is not in or above the
- 56 service factor.

- 1
2 C. With each chiller operating at near design temperature and water flow conditions,
3 measure and record the following:
4 1. Manufacturer, model number, serial number and all nameplate data.
5 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.)
6 and water quantity (GPM).
7 3. Condenser water entering temperature, leaving temperature, pressure drop (ft.)
8 and water quantity (GPM).
9 4. Evaporator and condenser refrigerant temperatures and pressures (using
10 instruments furnished with the machine by the manufacturer).
11 5. Volts and amps for each phase.
12 6. Power factor.
13 7. KW input.
14 8. Tons of cooling.
15 9. KW per ton of cooling.
16
17 D. Reference chiller specification for additional requirements.
18
19 3.10 CHILLERS (Air Cooled)
20
21 A. Balance flow of water through each evaporator to be within a range of 100% to 110% of
22 design flow with all pumps operating. With only one pump operating, the maximum flow
23 shall not exceed the maximum tube velocity recommended by the manufacturer.
24
25 B. Verification of safety interlocks and controls are the responsibility of the manufacturer.
26
27 C. With each chiller operating at near design temperature conditions, measure and record the
28 following:
29 1. Manufacturer, model number, serial number and all nameplate data.
30 2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.)
31 and water quantity (GPM).
32 3. Condenser air entering temperature, leaving temperature.
33 4. Evaporator and condenser refrigerant temperatures and pressures (using
34 instruments furnished with the machine by the manufacturer).
35 5. Volts and amps for each phase.
36 6. Power factor.
37 7. KW input.
38 8. Tons of cooling.
39 9. KW per ton of cooling.
40
41 D. Reference chiller specification for additional requirements.
42
43 3.11 TESTING THE VARIABLE AIR VOLUME SYSTEM
44
45 A. All VAV boxes used are to be calibrated to produce the rated air quantity.
46
47 B. Set and record the supply air static pressure controller to provide actual design air flow at
48 the most resistive terminal.
49
50 C. Measure and adjust the design air delivery at the inlet of each VAV box.
51
52 D. Measure and record the air quantity from each VAV box at its maximum flow.
53 Manipulate the controller to achieve maximum flow.
54
55 E. Reset each box to yield and record minimum primary air flow.
56 1. DDC controllers record the correction factor required to establish actual desired

- 1 air quantity as designed.
- 2 2. Pneumatic controllers adjust velocity controller as required to establish actual
- 3 desired air quantity as designed.
- 4
- 5 F. If the box is operating with inlet static pressure in excess of the minimum cataloged
- 6 pressure specified by the manufacturer and is not producing rated air quantity, field adjust
- 7 the box to produce rated air quantity. Retest until approved results are obtained.
- 8
- 9 G. Position the VAV boxes to the proportion of maximum fan air volume to total installed
- 10 box maximum volume.
- 11
- 12 H. Set the fan to deliver the AHUs scheduled design airflow.
- 13
- 14 I. Perform and record a total air traverse.
- 15
- 16 J. With the system terminal boxes set for full flow or diversity, the system will be
- 17 delivering the scheduled design CFM with the most restrictive box in control. Make a
- 18 speed increase if either or both static and volume are low.
- 19
- 20 K. Set the boxes to minimum and adjust the inlet vanes and or speed controllers to prevent
- 21 excessive static in the system.
- 22
- 23 L. Coordinate with the work specified in Building Management and Control System on the
- 24 final location of the sensors for the static pressure controller. Locate in the supply duct far
- 25 enough from the fan discharge to be truly representative of the average static pressure in
- 26 the system.
- 27
- 28 M. Modulate the fan speed on the supply fan. Adjust as required to coordinate with the static
- 29 pressure sensing network.
- 30
- 31 N. Make a set of recordings showing final system conditions including system duct static
- 32 pressures and control system setpoint.
- 33
- 34 3.12 DUCT TEST
- 35
- 36 A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the
- 37 duct test results, as completed, shall be submitted to the engineer for review within five
- 38 days. Provide a complete report of all the duct test results in the final TAB report.
- 39
- 40 3.13 DIRECT EXPANSION EQUIPMENT
- 41
- 42 A. With each unit operating at near design conditions, measure and record the following:
- 43 1. Manufacturer, model number, serial number and all nameplate data.
- 44 2. Ambient temperature, condenser discharge temperature.
- 45 3. Amperage and voltage for each phase.
- 46 4. Leaving and entering air temperatures.
- 47 5. Suction and discharge pressures and temperatures.
- 48 6. Tons of cooling.
- 49 7. Verification that moisture indicator shows dry refrigerant.
- 50
- 51 3.14 COOLING TOWERS
- 52
- 53 A. A complete CTI certified test of the cooling tower will be performed by others at the
- 54 expense of the cooling tower manufacturer. A copy of this test (provided by others) shall
- 55 be included in the final TAB Report. Balance the flow over and through bypass
- 56 connections of the tower.

3.15 TAB REPORT

- A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.
- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.
- C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
1. Title Page
 - a. Company Name
 - b. Company Address
 - c. Company telephone number
 - d. Project name
 - e. Project location
 - f. Project Manager
 - g. Project Engineer
 - h. Project Contractor
 - I. Project Identification Number
 2. Summary of the TAB report data
 3. Index
 4. Instrument List
 - a. Instrument
 - b. Manufacturer
 - c. Model
 - d. Serial Number
 - e. Range
 - f. Calibration Date
 - g. What test instrument is to be used for:
 5. Fan Data
 - a. Location
 - b. Manufacturer
 - c. Model
 - d. Air flow, specified and actual
 - e. Total static pressure (total external) specified and actual
 - f. Inlet pressure
 - g. Discharge pressure
 - h. Fan RPM
 6. Return Air/Outside Air Data
 - a. Identification/location
 - b. Design return air flow
 - c. Actual return air flow
 - d. Design outside air flow
 - e. Actual outside air flow
 - f. Return air temperature
 - g. Outside air temperature

- 1 h. Required mixed air temperature
- 2 I. Actual mixed air temperature
- 3 7. Electric Motors
- 4 a. Manufacturer
- 5 b. HP/BHP
- 6 c. Phase, voltage, amperage, nameplate, actual
- 7 d. PM
- 8 e. Service Factor
- 9 f. Starter size, heater elements, rating
- 10 8. V-Belt Drive
- 11 a. Identification/location
- 12 b. Required driven RPM
- 13 c. Drive sheave, diameter and RPM
- 14 d. Belt, size and quantity
- 15 e. Motor sheave, diameter and RPM
- 16 f. Center-to-center distance, maximum, minimum and actual
- 17 9. Duct Traverse
- 18 a. System zone/branch
- 19 b. Duct size
- 20 c. Area
- 21 d. Design velocity
- 22 e. Design air flow
- 23 f. Test velocity
- 24 g. Test air flow
- 25 h. Duct static pressure
- 26 I. Air correction factor
- 27 10. Air Monitoring Station Data
- 28 a. Identification/location
- 29 b. System
- 30 c. Size
- 31 d. Area
- 32 e. Design velocity
- 33 f. Design air flow
- 34 g. Test velocity
- 35 h. Test air flow
- 36 11. Air Distribution Test Sheet
- 37 a. Air terminal number
- 38 b. Room number/location
- 39 c. Terminal type
- 40 d. Terminal size
- 41 e. Correction factor
- 42 f. Design velocity
- 43 g. Design air flow
- 44 h. Test (final) velocity
- 45 i. Test (final) air flow
- 46 12. Pump Data
- 47 a. Identification/number
- 48 b. Manufacturer
- 49 c. Size/model
- 50 d. Impeller
- 51 e. Service
- 52 f. Design flow rate, pressure drop, BHP
- 53 g. Actual flow rate, pressure drop, BHP
- 54 h. Discharge pressure
- 55 I. Suction pressure
- 56 j. Total operating head pressure

- 1 k. Shut off, discharge and suction pressures
- 2 l. Shut off, total head pressure
- 3 m. Pressure differential settings
- 4 13. Cooling Coil Data
- 5 a. Identification/number
- 6 b. Location
- 7 c. Service
- 8 d. Manufacturer
- 9 e. Entering air DB temperature, design and actual
- 10 f. Entering air WB temperature, design and actual
- 11 g. Leaving air DB temperature, design and actual
- 12 h. Leaving air WB temperature, design and actual
- 13 i. Water pressure flow, design and actual
- 14 j. Water pressure drop, design and actual
- 15 k. Entering water temperature, design and actual
- 16 l. Leaving water temperature, design and actual
- 17 m. Air pressure drop, design and actual
- 18 n. Capacity - sensible and latent
- 19 14. Heating Coil Data
- 20 a. Identification/number
- 21 b. Location
- 22 c. Service
- 23 d. Manufacturer
- 24 e. Entering air DB temperature, design and actual
- 25 f. Leaving air DB temperature, design and actual
- 26 g. Water pressure flow, design and actual
- 27 h. Water pressure drop, design and actual
- 28 i. Entering water temperature, design and actual
- 29 j. Leaving water temperature, design and actual
- 30 k. Air pressure drop, design and actual
- 31 l. Capacity
- 32 15. Electric Coil Data
- 33 a. Identification/number
- 34 b. Location
- 35 c. Service
- 36 d. Manufacturer
- 37 e. Entering air DB temperature, design and actual
- 38 f. Leaving air DB temperature, design and actual
- 39 g. Electrical Characteristics
- 40 h. Capacity
- 41 16. Sound Level Report
- 42 a. Location (Location established by the design engineer)
- 43 b. N C curve for eight (8) bands-equipment off
- 44 c. N C curve for eight (8) bands-equipment on
- 45 17. Vibration Test on equipment having 10 HP motors or greater in size.
- 46 a. Location of points:
- 47 1) Fan bearing, drive end
- 48 2) Fan bearing, opposite end
- 49 3) Motor bearing, center (if applicable)
- 50 4) Motor bearing, drive end
- 51 5) Motor bearing, opposite end
- 52 6) Casing (bottom or top)
- 53 7) Casing (side)
- 54 8) Duct after flexible connection (discharge)
- 55 9) Duct after flexible connection (suction)
- 56 b. Test readings:

- 1 1) Horizontal, velocity and displacement
2 2) Vertical, velocity and displacement
3 3) Axial, velocity and displacement
4 c. Normally acceptable readings, velocity and acceleration
5 d. Unusual conditions at time of test
6 e. Vibration source (if non-complying)
7 18. Control verification indicating date performed and any abnormalities identified.
8 a. Point Location/Description
9 b. EMS Readout (Setpoint and Actual)
10 c. Actual Readout of all points
11 d. Interlocks
12 e. Safeties
13 f. Variable speed drive tracking with EMS input
14 g. Variable speed drive Bypass operation
15 h. Sequence of operation
16
17 END OF SECTION

SECTION 23 05 94

COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

- A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
- B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

- A. Bring the work to a state of readiness for testing, balancing, and adjusting.
 - 1. Install air terminal devices.
 - 2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
 - 3. Verify lubrication of equipment.
 - 4. Install permanent instrumentation.
 - 5. Clean piping systems and fill with clean water.
 - 6. Complete "Start-up" of equipment.
 - 7. Check rotation and alignment of rotating equipment and tension of belted drives.
 - 8. Verify ratings of overload heaters in motor starters.
 - 9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
 - 10. Provide control diagrams and sequence of operation.
 - 11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
 - 12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
 - 13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
 - 14. Comb out fins on extended-surface heat transfer coils where damaged.
 - 15. Clean all strainers as required.
 - 16. Remove construction strainers after water is cleaned and treated.
 - 17. Remove all temporary filters from HVAC equipment.
 - 18. Provide start-up reports listing all start-up information and manufacturer's information attached.
- B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
- C. Verify that the systems are ready for balancing and adjusting.
- D. Submit a letter stating:
 - 1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
 - 2. Other equipment has been checked and started.
 - 3. The systems have been operated for the specified period of time.
 - 4. The automatic controls system has been adjusted, calibrated, and checked, and is

- 1 operating as specified.
2
3 E. Provide the services of a technician full time at all times at the project when testing,
4 balancing and adjusting work is being conducted.
5
6 F. Provide instrumentation and services to take readings of the required data for the
7 refrigerant circuits.
8
9 G. Provide and install volume dampers required for balancing by the TAB Contractor.
10
11 3.2 START-UP OF EQUIPMENT
12
13 A. Pre-start & Start-up equipment using the procedures as recommended by the
14 manufacturers.
15
16 B. Complete start-up of equipment prior to start of testing & balancing.
17
18 C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC
19 FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

[illegible]

END OF SECTION

SECTION 23 07 13

EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install external insulation on supply, return, and outside air ductwork.
- B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

- A. Division 9 - FINISHES. Painting and Color Coding.
- B. Division 23 - MECHANICAL.
 - 1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
 - 2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
 - 3. Insulation. Refer to specific sections on individual insulation types.
 - 4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
- C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated system is not approved.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

- A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.
- B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

- A. Glass fiber rigid duct insulation.
 - 1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Schuller 814 spin-glas FSK.
 - b. Owens-Corning Type 703 board RKF.
 - c. Knauf 3 PCF FSK.
- B. Glass fiber blanket duct insulation.
 - 1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
 - 2. Acceptable Manufacturers
 - a. Manville R-series Microlite FSKL.
 - b. Owens-Corning ED100 RKF.
 - c. Knauf 1.0 PCF FSK.
- C. Fiberglass reinforcing cloth mesh.
 - 1. Acceptable Manufacturers
 - a. Perma Glass Mesh.
 - b. Alpha Glass Mesh.
 - c. Childers Chil-Glas #10
 - d. Foster Mast a Fab
 - e. Vimasco.
- D. Mastics, sealants, coatings and adhesives.
 - 1. Acceptable Manufacturers
 - a. Childers.
 - B. Foster.
 - c. Vimasco.
- E. Fireboard Insulation
 - 1. Totally encapsulated with foil facing.

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
2. Two hour rated fire protection.
 3. Zero clearance to combustible protection.
 4. System shall be listed and labeled by an NRTL.
 5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
 6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
 7. Acceptable Manufacturers
 - a. Unifrax ON Fyrewrap Elite 1.5
 - b. Partak Insulation, Inc. Paroc Fireboard
 - c. Thermal Ceramics FireMaster 3M
 - d. Premier Refractories International, Pyroscat.
- F. Rigid Closed Cell Insulation
1. Acceptable Manufacturers
 - a. Dow Trymer.
 - b. Phenolic Foam.
- G. Reinforced Foil Tape
1. Acceptable Manufacturers
 - a. Venture 1525CW
 - b. 3" FSK
 2. Thickness 6.5 mils
 3. Color: silver
- 2.2 COATING AND ADHESIVE
- A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249.
- C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
- D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.
- 2.3 OUTDOOR DUCT LAMINATED JACKETING
- A. Rubberized bitumen compound material:
1. Ultraviolet resistant
 2. Weatherproof
 3. Vapor retarding jacketing
 4. Laminated jacketing
 5. Cross-laminated high strength polyethylene film
 6. Laminated to aluminum foil
 7. Minimum 60-mil thickness
- B. Acceptable Manufacturers:
1. Alumaguard 60
 2. Flex Clad 400
 3. Venture Clad 1577CW

PART 3 - EXECUTION

1
2 3.1 FIRE SAFETY REQUIREMENTS
3

- 4 A. Do not extend duct coverings through walls or floors required to be fire-stopped or
5 required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity
6 of heat sources such as electric resistance or fuel-burning heater.
7

8 3.2 CONCEALED DUCT
9

- 10 A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-
11 Skrim-Kraft (FSK) facing.
12
13 B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the
14 insulation with 0.6 lb. per cubic foot density, 1-1/2" thick, faced, flexible blanket
15 insulation. Insulation shall not prevent adjustment of damper operators.
16
17 C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted
18 and longitudinal joints overlapped a minimum of 2". In addition, secure insulation to the
19 bottom of rectangular ductwork by the use of either weld pins with washers or cup-head
20 pins welded to the ductwork or perforated based insulation hangers glued to the duct on
21 twelve inch centers to prevent sagging of insulation.
22
23 D. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward
24 clinch steel staples on 2" centers and taped using 3" wide foil tape applied with additional
25 adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with
26 foil tape and glue.
27
28 E. Ductwork in mechanical rooms is considered concealed spaces.
29

30 3.3 EXPOSED DUCT INSULATION
31

- 32 A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board
33 insulation.
34 1. Apply fabric and mastic to provide a smooth surface for painting.
35
36 B. Standing Seams: Insulate standing seams and stiffeners which protrude through the
37 insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor
38 seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent
39 adjustment of damper operators.
40
41 C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with
42 adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use
43 of either weld pins with washers or cup-head pins welded to the ductwork or perforated
44 based insulation hangers glued to the duct on 12 inch centers to prevent sagging of
45 insulation.
46
47 D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with
48 reinforcing mesh. Fabric shall not be visible after coating.
49

50 3.4 OUTDOOR DUCTWORK COVERING
51

- 52 A. Cover all supply and return ductwork outdoors:
53 1. 1-1/2" thick, rigid closed cell insulation with reinforced foil facing.
54
55 B. Install a high point in center and slope in both directions so water will not stand on
56 horizontal surfaces.

- 1
2 C. Impale the insulation over mechanical fasteners and washers.
3 1. A minimum of 2 rows of fasteners per side on 12-inch centers.
4 2. Seal all breaks, joints and punctures by applying a 1/8" thick vapor barrier
5 mastic coating, embedded in open mesh reinforcing mesh.
6
7 D. Standing S, or flanged connections shall be covered with the same thickness of insulation
8 overlapped a minimum of 4".
9
10 E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the
11 entire surface.
12 1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be
13 smoothly applied and pressed into the mastic. The cloth shall be taut with
14 adjacent edges overlapped a minimum of 4".
15 2. After the first coat of mastic has taken its set, the second coat shall be applied
16 over the cloth by palm, trowel, or spray to sufficient thickness that, when dried,
17 the combined thickness of mastic and cloth is not less than 1/8".
18 3. Upon completion, the openings in the cloth shall be completely sealed and the
19 yarn shall not be visible. The completed work shall be completely smooth and
20 present a plane surface.
21 4. Aluminum gray or white finish as approved by the Architect.
22
23 F. Standing water on horizontal surfaces is not approved.
24
25 G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply
26 rubberized bitumen compound, applied to a cross-laminated high strength polyethylene
27 film, laminated to aluminum foil.
28
29 3.5 GENERAL INSTALLATION
30
31 A. Install materials in accordance with manufacturer's instructions.
32
33 B. Apply insulation on clean, dry surfaces only.
34
35 C. Continue insulation with vapor barrier through penetrations.
36
37 D. Neatly finish insulation at supports, protrusions and interruptions.
38
39 E. Install insulation on clean, dry surfaces, and only after building is weatherproofed
40 sufficiently to preclude any rainwater on insulation.
41
42 F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not
43 visible after completion.
44
45 G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.
46
47

END OF SECTION

SECTION 23 08 00

MECHANICAL COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 23 Mechanical.
- B. Related Sections:
 - 1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
 - 2. Division 22 – Plumbing
 - 3. Division 23 – Mechanical
 - 4. Division 26 – Electrical

1.2 DEFINITIONS

- A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

- A. The Owner will contract directly for commissioning services.
 - 1. Commissioning Agent fee will be paid for directly by the owner.
 - 2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing including, but not limited to equipment listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0°F and a resolution of + or - 0.2°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.
- C. Test equipment includes:
 - 1. Air flow measuring devices (hoods, anemometers, etc.)
 - 2. Water flow measuring devices
 - 3. Temperature measuring devices (air and water)
 - 4. Humidity sensors
 - 5. Pressure gauges (air and water)
 - 6. CO2 sensors

1 2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT

- 2
3 A. Ladders and/or lifts and appropriate fall protection as required by Contractor site
4 requirements.
5

6 PART 3 - EXECUTION

7
8 3.1 COORDINATION - GENERAL
9

- 10 A. Except for the activities to be performed by the CxA called for herein, all component and
11 system installation work required by the Division 22, 23 and 26 specifications including
12 specific contractor furnished items indicated by this Section shall be provided by the
13 Contractor.
14

15 3.2 SUBMITTALS
16

- 17 A. Mechanical
18 1. Ductwork Layouts
19 2. Piping Layouts
20 3. Equipment Room Layouts
21 4. Mechanical Equipment as needed
22

23 3.3 EQUIPMENT START-UP
24

- 25 A. Notification
26 1. Contractor shall provide ten Owner business days' notice to CxA, Owner and
27 Design Team of start-up dates.
28
29 B. Prior to start-up, contractor shall:
30 1. Verify that equipment and systems are complete, accessible, correctly connected
31 to utilities and ready for operation. Perform all pre-start inspections and tests as
32 called for in Division 23.
33 2. Comply with pre-start requirements of manufacturer and complete applicable
34 documentation.
35 3. Complete applicable sections of Prefunctional Checklists.
36 4. Coordinate start-up attendance by manufacturer or authorized representative as
37 required by specifications or manufacturer.
38
39 C. At start-up, contractor shall:
40 1. Supervise the activities of the authorized start-up technician or manufacturer's
41 representative.
42 2. Verify proper voltage, phase, overcurrent protection, drive rotation and any other
43 conditions that may cause damage if not correct.
44 3. Execute start-up under supervision of qualified contractor and equipment
45 manufacturer personnel and in accordance with the manufacturer's instruction.
46 4. Complete manufacturer start-up requirements and documentation. Provide a copy
47 of documentation to the CxA for inclusion in the Cx Manual.
48 5. Complete PFC's and provide documentation to CxA.
49 6. Provide documentation of any issues noted during start-up to CxA, Owner and
50 Design Team. Outline recommendations for corrective action.
51

52 3.4 PIPE AND DUCT PRESSURE/LEAKAGE TESTING
53

- 54 A. General
55 1. The following procedures are meant as general procedures and do not alleviate
56 Contractor of more stringent procedures specified elsewhere in Division 23.

- 1
2 B. Notification
3 1. Contractor shall provide adequate notice to CxA, Owner and Design Team of
4 testing dates.
5
6 C. Duct Pressure Testing:
7 1. Prior to testing, contractor shall:
8 a. Select duct sections with approval by Design Team.
9 b. Calculate duct areas and acceptable leakage rates.
10 c. Verify that test equipment is of appropriate capacity for duct sections
11 tested. Ideally, the pressure testing equipment will be at the midpoint of
12 the system tested.
13 d. Verify that test equipment has been calibrated with NIST traceable
14 certificates within the past 12 months or shorter time span if specified
15 elsewhere in Division 23.
16 e. Isolate and seal duct sections.
17 2. During testing, contractor shall:
18 a. Conduct testing in a safe manner.
19 b. Operate test equipment at a minimum of 3" wg for ductwork between
20 AHU and terminal unit, or as specified elsewhere in Division 23.
21 c. Operate test equipment at a minimum of 2" wg for ductwork downstream
22 of terminal units and exhaust ductwork, or as specified elsewhere in
23 Division 23.
24 d. Record all applicable test data.
25 3. Upon completion of testing, contractor shall:
26 a. Remedy sections that do not pass and schedule a retest.
27 b. Submit test results to Owner, Design Team and CxA for review.
28
29 D. Pipe Pressure Testing
30 1. Prior to testing, contractor shall:
31 a. Verify that test equipment has been calibrated with NIST traceable
32 certificates within the past 12 months or shorter time span if specified
33 elsewhere in Division 23.
34 b. Isolate and seal pipe sections to be tested.
35 c. Isolate equipment or apparatus connected to the piping system that may
36 be damaged during the testing.
37 d. Clean and flush piping sections and fill with clean water, venting all air.
38 e. Allow adequate time for water and piping to reach ambient temperature.
39 2. During testing:
40 a. Maintain a safe condition in the area surrounding the test system.
41 b. Pressurize piping to 150% of design working pressure, but not greater
42 than piping design pressure.
43 c. Pipe shall hold pressure for minimum of 2 hours.
44 d. Record temperature of piping and ambient air at beginning and end of
45 test.
46 e. Record pressure on piping system at beginning and end of test.
47 3. Upon completion of testing, contractor shall:
48 a. Remedy sections that do not pass and schedule a retest.
49 b. Submit test results to Owner, Design Team and CxA for review.
50

51 3.5 PRE-FUNCTIONAL CHECKLISTS

- 52
53 A. Contractor shall forward completed copies of PFCs to the CxA for inclusion into the Cx
54 documentation. PFCs will be provided by the CxA. As an alternate, contractor shall submit
55 their versions of the PFCs to the CxA for review and comment.
56

- 1 B. Contractor shall complete PFC for each of the following equipment:
2 1. Mechanical:
3 a. Air Handling Units
4 b. Energy Recovery Units
5 c. Terminal Units
6 d. Pumps
7 e. Fans
8 f. Heaters
9 g. Split Systems
10 h. Heat Exchanger/Converter
11 i. Chiller
12 j. Boiler
13 k. Valves
14

15 3.6 TEST AND BALANCE
16

- 17 A. Contractor shall forward the T&B Execution Plan to the CxA prior to performing the field
18 T&B activities. CxA will review and comment on Plan.
19
20 B. Contractor shall notify CxA a minimum of three (3) days prior to conducting field T&B
21 activities. Failure to provide CxA with adequate notification may result in additional field
22 time by T&B Contractor to demonstrate T&B results.
23
24 C. Key T&B activities that CxA requires notification on:
25 1. Terminal Units.
26 2. Air Handling Unit.
27 3. Energy Recovery Unit.
28 4. Heat Exchanger/Converter.
29 5. Pumps.
30

31 3.7 FUNCTIONAL TESTING
32

- 33 A. General
34 1. Contractor shall organize and schedule Construction Team members to execute
35 the functional testing, which will be directed by CxA. Construction Team
36 members may include Mechanical Sub, T&B Sub, Controls Sub, Electrical Sub,
37 Fire Alarm Sub or Plumbing Sub. Contractor shall note that certain activities, such
38 as sensor calibration, can be organized so that the T&B Sub is scheduled
39 efficiently.
40
41 C. Air Cooled Chillers
42 1. Graphics
43 2. Start/Stop/Schedule
44 3. Compressor Operation (On/Off/Hand/Auto)
45 4. Entering/Leaving Temperature
46 5. Safeties
47 6. Alarms
48 7. Temperature Reset Sequences
49
50 D. Boilers
51 1. Graphics
52 2. Start/Stop/Schedule
53 3. Firing Operation (On/Off/Hand/Auto)
54 4. Entering/Leaving Temperature
55 5. Safeties
56 6. Alarms

1		7.	Temperature Reset Sequences
2			
3	E.		Air Handling Units
4		1.	Graphics
5		2.	Start/Stop/Schedule
6		3.	Fan Operation (On/Off/Hand/Auto)
7		4.	Temperature Calibration (Air/Water)
8		5.	Damper Positions (Off/On/Safety)
9		6.	Valve Positions (Off/On/Safety)
10		7.	Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
11		8.	Alarms (Filter/Temperature/etc.)
12		9.	Damper Operation (Normal/Economizer)
13		10.	Valve Operation (Normal Heating & Cooling/Economizer)
14		11.	Fan Speed Control (VFD)
15		12.	Temperature Reset Sequences
16		13.	Static Reset Sequences
17			
18	F.		Energy Recovery Units
19		1.	Graphics
20		2.	Start/Stop/Schedule
21		3.	Fan Operation (On/Off/Hand/Auto)
22		4.	Temperature Calibration (Air/Water)
23		5.	Air Flow Station Calibration
24		6.	Damper Positions (Off/On/Safety)
25		7.	Valve Positions (Off/On/Safety)
26		8.	Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
27		9.	Alarms (Filter/Temperature/etc.)
28		10.	Damper Operation (Normal/Economizer)
29		11.	Valve Operation (Normal Heating & Cooling/Economizer)
30		12.	Fan Speed Control (VFD)
31		13.	Temperature Reset Sequences
32		14.	Static Reset Sequences
33			
34	G.		Terminal Units
35		1.	Graphics
36		2.	Start/Stop/Schedule
37		3.	Fan Operation (On/Off/Hand/Auto)
38		4.	Temperature Calibration (Air/Water)
39		5.	Thermostat Operation
40		6.	Damper Positions (Off/On/Safety)
41		7.	Valve Positions (Off/On/Safety)
42		8.	Safeties (Smoke Detectors/Fire Alarm)
43		9.	Alarms (Temperature/etc.)
44		10.	Unoccupied Overrides
45			
46	H.		Pumps
47		1.	Graphics
48		2.	Start/Stop/Schedule
49		3.	Pump Operation (On/Off/Hand/Auto)
50		4.	Flow Station Calibration
51		5.	Pressure Sensor Calibration
52		6.	Pump Speed Control (VFD)
53		7.	Sequencing and Alarms
54			
55	I.		Fans
56		1.	Graphics

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
- 2. Start/Stop/Schedule
 - 3. Thermostat Operation
 - 4. Flow Station Calibration
 - 5. Pressure Sensor Calibration
 - 6. Speed Control (VFD)
 - 7. Sequencing and Alarms
- J. Heaters
- 1. Graphics
 - 2. Start/Stop/Schedule
 - 3. Thermostat Operation
 - 4. Flow Station Calibration
 - 5. Sequencing and Alarms
- K. Split Systems
- 1. Graphics
 - 2. Start/Stop/Schedule
 - 3. Fan Operation (On/Off/Hand/Auto)
 - 4. Temperature Calibration
 - 5. Thermostat Operation
 - 6. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
 - 7. Alarms (Filter/Temperature/etc.)
 - 8. Fan Speed Control (VFD)
- L. Recirculation Pump
- 1. Graphics
 - 2. Start/Stop/Schedule
 - 3. Pump Operation (On/Off/Hand/Auto)
 - 4. Temperature Sensor Calibration
- 3.8 TREND DATA
- A. Contractor shall enable trend data as indicated herein and as specified by contract documents and Owner's requirements. Trends shall be stored to a repository device that can be recalled at any time period. Sampling rate shall vary based upon the trend and may range from change of value (COV) to a maximum of 15 minutes.
- B. Ambient (Outdoor) Conditions
- 1. Dry Bulb Temperature
 - 2. Wet Bulb Temperature
 - 3. CO2 Level
- C. Building Loop Chilled Water System
- 1. Chilled Water Flow.
 - 2. Chilled Water Supply Temperature.
 - 3. Chilled Water Return Temperature.
 - 4. Chilled Water Pressure Differential.
 - 5. Chilled Water Pressure Setpoint.
 - 6. Pump 1 Speed.
 - 7. Pump 2 Speed.
- D. Building Loop Hot Water System
- 1. Hot Water Flow.
 - 2. Hot Water Supply Temperature.
 - 3. Hot Water Return Temperature.
 - 4. Hot Water Pressure Differential.

1		5.	Hot Water Pressure Setpoint.
2		6.	Pump 1 Speed.
3		7.	Pump 2 Speed.
4			
5	E.		Air Handling Unit Supply Air
6		1.	Supply Air Temperature.
7		2.	Supply Air Temperature Setpoint.
8		3.	Mixed Air Temperature.
9		4.	Mixed Air Temperature Setpoint.
10		5.	Chilled Water Valve Position.
11		6.	Hot Water Valve Position.
12		7.	Critical Terminal Unit Air Valve and Heating Position
13			
14	F.		Air Handling Unit Static Pressure
15		1.	Duct Static Pressure.
16		2.	Duct Static Pressure Setpoint.
17		3.	Fan Speed
18		4.	Critical Terminal Unit Air Valve Position
19			
20	G.		Air Handling Unit Economizer
21		1.	Supply Air Temperature.
22		2.	Supply Air Temperature Setpoint.
23		3.	Mixed Air Temperature.
24		4.	Mixed Air Temperature Setpoint.
25		5.	Return Air Temperature.
26		6.	Return Air Enthalpy.
27		7.	Outside Air Temperature.
28		8.	Outside Air Enthalpy.
29		9.	Chilled Water Valve Position.
30		10.	Hot Water Valve Position.
31		11.	Return Damper Position
32		12.	Relief Damper Position
33		13.	Outside Air Damper Position
34			
35	H.		Terminal Units
36		1.	Room Temperature.
37		2.	Room Temperature Setpoint.
38		3.	Supply Air Temperature.
39		4.	Inlet Air Flow.
40		5.	Inlet Air Valve Position.
41		6.	Heating Coil Valve Position.
42		7.	Fan Status.
43		8.	Room CO2.
44			
45	I.		Split System Units
46		1.	Room Temperature.
47		2.	Room Temperature Setpoint.
48		3.	Supply Air Temperature.
49		4.	Fan Status.
50		5.	Cooling/Heating Mode.
51			
52	J.		Fans
53		1.	Room Temperature.
54		2.	Room Temperature Setpoint.
55		3.	Fan Status/Speed.
56			

- 1 K. Heaters
- 2 1. Room Temperature.
- 3 2. Room Temperature Setpoint.
- 4 3. Status.
- 5
- 6 END OF SECTION

SECTION 23 09 33

BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. Provide and install a complete Building Management and Control System (BMCS), including industrial instrumentation necessary to obtain functions and results specified. A complete system includes items such as sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
- B. Temperature Control System components:
 - 1. Electronic instruments as specified
 - 2. Electric instruments as specified
 - 3. Microcomputer instruments as specified
- C. All control devices of the same type product shall be of a single manufacturer.
- D. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
 - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
 - 1. All components and elements
 - 2. The testing and acceptance procedure
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
 - 1. All components and elements.
 - 2. Start-up and point verification.
 - 3. The testing and acceptance procedure.

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).
 - 1. Temperature control equipment & Field devices.
 - 2. Wiring & Flow diagrams.

3. Sequence of operation.
4. Complete, detailed, control and interlock-wiring diagram.
5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.
6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply", "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 WARRANTY

- A. Provide with a manufacturer's parts and labor warranty for a period of two years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Automated Logic Controls by ALC Houston
- B. Reliable by Unify Energy Solutions

2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.
- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.
- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.
- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be

considered only if a similar device is provided as a stand-by. Upon a failure of malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.

- C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.
- D. Network shall support a minimum communications speed of 115.2 Kbps.
- E. The network shall support a minimum of 100 DDC controllers and PC workstations.
- F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.
- G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.
- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
 - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
 - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
 - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
 - 4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.
- E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
 - 1. Control processes
 - 2. Energy management applications
 - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - 4. Historical/trend data for points specified
 - 5. Maintenance support applications

6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring

- G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
 3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.
1. Point database
 2. Operator interface
 3. Network communications
 4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.
- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

- 1
2 A. The BMCS shall be provided with standard and custom report generation functions that
3 include:
4 1. Alarm summaries
5 2. Motor status summaries
6 3. Point displays by type, system, status, overrides, failures, location, equipment
7 and enabled/disabled.
8 4. Program listings
9
10 B. All reports shall be either displayed or printed by:
11 1. Operator request.
12 2. Time of day.
13 3. Event conditions (such as in response to an alarm, interlock, etc.).
14
15 C. All reports shall be time and date stamped.
16
17 D. An alarm-processing program shall be provided to annunciate those points designated as
18 alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at
19 designated terminals.
20
21 E. Historical trend data shall be collected and stored at each DDCP for later retrieval.
22 Retrieval shall be manual or automatic. Any point, physical or calculated, may be
23 designated for trending. The system shall allow for two methods of trend collection:
24 Either by a pre-defined time interval sample or upon a pre-defined change of value.
25 Trend data shall be presented in a columnar format. Each sample shall be timed stamped.
26 Trend reports may be a single point or may be a group of points, up to a maximum of (8)
27 points in any single group. Any point, regardless of physical location in the system may
28 become part of a multiple point group.
29
30 F. Each BMCS network shall provide a point-monitoring function that can display single or
31 multiple points in a continuous updated fashion for dynamic displays of point values.
32
33 G. A database and configuration report program shall be provided that allows the user to
34 interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM
35 at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.
36
37 H. Any invalid operator entry shall result in an error message.
38
39 I. DDCP's shall contain a password access routine that will assign an operator to one of
40 three level of access. Level 1 shall permit display function only, level 2 shall additionally
41 permit commanding of system points and level 3 shall additionally permit full program
42 and database editing.
43
44 J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-
45 time or energy totalization. Totalized values may be displayed or printed automatically or
46 by operator request.
47
48 2.7 ENERGY MANAGEMENT SOFTWARE
49
50 A. The BMCS shall be provided with an optimal start program such that the building may be
51 divided into ten zones for optimum start. Warm-up and cool-down shall occur in
52 sequence with succeeding zones starting only after the preceding zone has completed its
53 warm-up or cool-down.
54 1. The optimum start-up time of assigned equipment shall be determined based on
55 a software calculation that takes into consideration outdoor air conditions, space
56 conditions, and building thermal characteristics ("U" factor).

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
 3. A built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.
1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
 2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
 3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
 4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
 5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.
- C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:
1. Enthalpy optimization.
 2. Supply air reset.
 3. Hot water reset.
 4. Chilled water reset.
 5. Volumetric control.
 6. Dead band control. Install dual set points as requested by user.
 7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.
- 2.8 WEB SERVER ACCESSIBILITY
- A. Industry leading encryption technology to provide accessibility through a web browser.
- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
1. Alarm Display
 2. Point Commanding
 3. Graphic Display
 4. Scheduling
 5. Running Reports
 6. Point Details

2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
1. Alphanumeric pagers
 2. Numeric pagers
 3. Email
 4. Phones via voice or short message service (SMS)

2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
1. Modules may be mounted remote from the DDCP.
 2. Shall communicate with the DDCP over a pair of twisted cables.

2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
1. Variable Air Volume (VAV) boxes
 2. Constant Air Volume (CAV) boxes
 3. Dual Duct Terminal Boxes
 4. Unit Conditioners
 5. Heat Pumps
 6. Unit Ventilators
 7. Room Pressurization
 8. Fan Coil Units
- B. Include the following items:
1. All input and outputs necessary to perform the specified control sequences.
 - a. Analog outputs shall be industry standard signals such as 24V floating control.
 2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
 3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
 4. Return to full normal operation without user intervention after a power outage of unlimited duration.
 5. Operation programs shall be field selectable for specific applications.
 6. Specific control strategy requirements, allowing for additional system flexibility.
 7. Controllers that require factory changes of all applications are not acceptable.

2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
1. Spring return to full travel position.
 2. Built in auxiliary switches (motor end switches)
 - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
 3. Minimum torque 60-in-lb
- B. Modulating damper operators:
1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30
- 31
- 32
- 33
- 34
- 35
- 36
- 37
- 38
- 39
- 40
- 41
- 42
- 43
- 44
- 45
- 46
- 47
- 48
- 49
- 50
- 51
- 52
- 53
- 54
- 55
- 56

6

8

- 9

10

12

- 13
14
15
16
17
18
19

22

24

- 25
26
27
28
29

32

- 33
34
35
36
37
38
39
40
41
42
43
44
45

48

- 49
50
51
52
53
54
55

- 1 D. Outside Air Sensors
2 1. Range of -58° to 122°F.
3 2. Weatherproof sun shield.
4 3. External trim material corrosion resistant with all parts assembled into water
5 tight, vibration-proof, heat resistant assembly.
6 4. Minimum of 8' long leads.
7 5. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture
8 proofing material and lag extension for thickness of insulation.
9

10 2.16 CURRENT SENSITIVE RELAYS
11

- 12 A. Ensure compatibility with VFD applications for variable speed motor status.
13 1. Provide with adjustable set point.
14 2. Relays must be mounted and not hung by power wires thru CT.
15 3. Provide split-core type current sensors.
16 4. Loop powered.
17 5. LED Status.
18 6. Acceptable Manufacturer: Veris Industries / Hawkeye
19 7. Relays shall close status contacts in response to current flow in power leads to
20 the equipment being monitored.
21

22 2.17 DIFFERENTIAL PRESSURE TRANSDUCER
23

- 24 A. Transducers to convert differential pressures to 4-20 MA analog outputs.
25 1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
26 2. Factory calibrated and have zero and span trimmers for field calibration.
27 3. Range shall be selected to match the medium being monitored.
28 4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve
29 assembly to protect the transducer from overpressure damage during start-up.
30 5. LCD Display
31 6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter
32

33 2.18 ELECTRIC REMOTE BULB THERMOSTAT
34

- 35 A. Two position remote bulb thermostat:
36 1. Bimetal controlled.
37 2. Sealed mercury switches.
38 3. Provide specified control action.
39 4. Adjustment can be made by removing unit cover.
40 5. Element with capillary length as required for the location.
41

42 2.19 ELECTRIC SPACE THERMOSTAT
43

- 44 A. Two position space thermostat.
45 1. Single Pole switch actuated by bi-metal sensing element.
46 2. Range shall be 60°F to 90°F.
47 3. Removable external knob adjustment means.
48

49 2.20 HIGH STATIC PRESSURE SWITCH
50

- 51 A. With manual reset switch
52 1. Approved manufacturer: Cleveland AFS-460.
53

54 2.21 CONTROL DAMPERS
55

- 56 A. Opposed blade dampers.

1. Frames of 13-gauge galvanized sheet metal.
2. Provisions for duct mounting.
3. Damper blades not exceeding 8" in width.
4. Blades of two sheets of 16-gauge galvanized sheet metal.
5. Blades suitable for high velocity performance.
6. Bearings of nylon or oil-impregnated, sintered bronze.
7. Shafts of 1/2" zinc-plated steel
8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
10. Submit leakage and flow characteristics data with shop drawings.
11. Linkage shall be concealed out of the air stream within damper frame.
12. Acceptable Model is Ruskin Model CD60.

2.22 PHOTO CELL CONTROL

- A. Light Sensitive Resistor.
1. 4-20 output or switch.
 2. On = 3.0 / fc. Off 10.0 / fc.
 3. UL Approved.

2.23 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps.
1. Shuts off equipment if water level becomes too high.
 2. DPDT Contacts.

2.24 BY-PASS AUTOMATIC SHUT-OFF TIMERS

- A. Rated at 10 Amps, 125 VAC
1. Shuts off equipment with timed switch
 2. White decorated timer
 3. Without hold feature
 4. Time Cycle 60 minutes

2.25 CO₂ SENSOR

- A. Telaire Model T5100 CO₂/Temperature Sensor or approved equal
1. Local visual indication of CO₂ levels in enclosed spaces.
 2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO₂ levels
 3. Bright LED indicator transitions between green, yellow, and red as the CO₂ threshold is exceeded.
 - a. Accuracy: +/- 30 ppm @ 72°F
 - b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

2.26 HVAC SHUTDOWN STATION

- A. Lockdown Switch:
1. Mushroom Red Button within a clear plastic cover
 2. Latches when depressed
 3. Twist reset
 4. Sign "HVAC SHUTDOWN"
 5. Manufactured by STI Model #SS2031HV-EN

2.27 AIR CONDITIONING SHUTDOWN STATION

- 1
2 A. AC Button:
3 1. Mushroom YELLOW Button within a clear plastic cover
4 2. Momentary illuminated red.
5 3. Shell label "AIR CONDITIONING SHUTDOWN"
6 5. Manufactured by STI Model # SS276ZA-EN
7
8 PART 3 - EXECUTION
9
10 3.1 INSTALLATION
11
12 A. The control system shall be installed and final adjustments made by full-time employees
13 of the factory-approved BMCS Building Management Control Subcontractor.
14
15 B. The contractor shall collaborate through Architect / Engineer and Owner to determine the
16 Owner's preference for naming conventions, etc. before entering the data in to the system.
17
18 C. Due to actual operational or space conditions, it may be necessary for the Contractor to
19 make sequence of operation modifications and/or controller adjustments, change the
20 location or type of sensor to obtain proper operation and coverage of the system in each
21 room or space. These change, if requested by the Owner or Engineer, shall be performed
22 at no additional cost to the Owner. Therefore labor allowances should be made for such
23 changes and adjustments if requested.
24
25 D. Points listed within this section are to be connected to the BMCS system as hard-wired
26 points to cards and not connected through BacNet integration. The BacNet interface is for
27 read only points not included within sequences of this specification.
28
29 3.2 INTERLOCK AND SAFETY CIRCUITS
30
31 A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is
32 de-energized:
33 1. The damper and actuators are specified in this section.
34 2. Outdoor air damper shall be fully opened before related air handling unit fan is
35 energized for 100% outside air use.
36 3. Provide motorized outside air dampers for the following:
37 a. Supply fans
38 b. AHUs
39 c. Exhaust fans (except kitchen exhaust)
40
41 B. Close the chilled and hot water valves to the coil when the related unit is de-energized.
42
43 C. Interlock each chiller to start its dedicated chilled and condenser water pumps.
44 1. On shutdown provide a circuit to permit the chilled water pumps and condenser
45 water pumps to run while the chillers pump down as required by the
46 manufacturer.
47 2. As per manufacturer's recommendations
48
49 D. Primary chilled water control:
50 1. Operating and safety controls are furnished as an integral part of the water-
51 chilling unit and not specified in this section.
52 2. Provide a high limit temperature sensor in each primary chilled water pump
53 loop.
54
55 E. Exhaust/Supply Fans:

1. Interlock the related exhaust and supply fans and the related outside air damper.
2. Interlock the exhaust fans with the related air-handling unit through software.
3. Interlock related exhaust fan for dishwasher with time delay off relay.
4. Interlock related exhaust fan for kiln with time delay off relay
5. Interlock kitchen hood related supply and exhaust fans.
6. Provide additional interlocks as indicated on fan schedule and on drawings.
7. Interlock electrical and mechanical room exhaust fans with thermostat.
8. Interlock refrigerant monitor with mechanical room purge system.
9. Interlock science room related supply and exhaust fans.
10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.

F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor, oil level switch and oil pump on each cooling tower fan.

G. Freeze Protection:

1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
 - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
 - b. Boilers - Enable during a freeze condition.
 - c. Chillers – Open isolation valves then command by-pass valve to dump water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
 - d. Air Cooled Chillers – Open isolation valves, then enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
 - e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.
2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.

H. Drain Pan Float Protection:

1. Interlock to shut down unit and close valves.
2. Cooling Coils mounted above ceiling and in roof mounted units.
3. Provide for each cooling coil location.
4. Signal BMCS alarm point

I. Domestic Water System:

1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.

- 1
- 2
- 3 J. Emergency Shutdown Station:
 - 4 1. Provide an emergency mushroom style push / pull station shutdown switch in
 - 5 the Administration Area or as directed by Owner / Architect.
 - 6 2. Signal the building automation system to de-energize the HVAC equipment.
 - 7 3. This is to stop exhaust fans and outside air units immediately.
 - 8 4. Other air handling units, chillers and equipment shall be shut down in an orderly
 - 9 manner so as to not damage the equipment.
 - 10 5. Once stopped, the system may only be restarted with a key operated switch
 - 11 located adjacent to the shutdown switch.
- 12 K. Science Room Utility Controllers:
 - 13 1. Interlock the utility controllers with related air-handling unit through software.
 - 14
- 15 L. Copper Tube Boiler:
 - 16 1. Interlock each boiler to start its dedicated primary circulating pump. Interlock
 - 17 flow switch and pump to boiler safety terminal strip.
 - 18 2. On startup enable boiler and primary pump prior to starting secondary system
 - 19 pump until primary loop temperature reaches 105 degrees as per manufacturer's
 - 20 recommendations.
 - 21 3. Disable secondary pump if boiler goes into alarm or fails to produce heating
 - 22 water within 30 minutes.
 - 23
- 24 M. Hydronic Heating Boiler:
 - 25 1. Interlock each boiler to start its dedicated pump.
 - 26 2. On startup enable boiler prior to starting primary pump. Boiler should reach
 - 27 operating temperature prior to starting system pump as per manufacturer's
 - 28 recommendations.
 - 29 3. Disable system pump if boiler goes into alarm or fails to produce heating water
 - 30 within 30 minutes.
 - 31
- 32 N. Condensing and Non-Condensing Hot Water Boilers:
 - 33 1. Interlock each boiler to start its dedicated pump.
 - 34 2. Install communication cable between each boiler and master controller specified
 - 35 by boiler manufacturer.
 - 36
- 37 3.3 GRAPHICS
- 38
- 39 A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the
- 40 complete Building Management Control System.
 - 41 1. Modification of existing control systems shall be included.
 - 42 2. These must be as-built and any changes during the warranty period drawings
 - 43 must be revised and updated.
 - 44 3. Provide final sequence of operation in written format.
 - 45
- 46 B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in
- 47 plastic and hung in the main mechanical room or as directed by Owner.
- 48
- 49 C. Provide a color-coded floor plan of the building showing the location of each system, and
- 50 the area served by each AHU or related zone. These must be of professional quality.
- 51 Floor plan is to hang in main mechanical room near central control panel.
- 52
- 53 D. Provide computer graphics for each system.
- 54
- 55 E. Provide final graphic room numbers as selected by Owner / Architect.. Obtain a graphic
- 56 submittal package for review. Construction Drawing room numbers are not to be used

unless approved in writing.

3.4 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
 - 1. Wiring of interlock system.
 - 2. Wiring of control instruments.
 - 3. Wiring of control panels.
 - 4. Wiring of related power supplies, i.e. transformers.
 - 5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.
- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.
- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridge rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
- H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.

- 1 I. All wiring associated with building management and control system cover shall be as
- 2 follows:
- 3 1. Sensor jacket color, Green
- 4 2. LAN communications, Yellow
- 5 3. All THHN wiring shall comply with Division 26 insulation color identification

6 3.6 EXHAUST AND SUPPLY FANS

- 7 A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- 8
- 9 B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked
- 10 and/or specified throughout project.
- 11
- 12 C. Provide by-pass timers for fans indicated in Fan Schedule.
- 13
- 14
- 15

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Outside Air Damper	DO	Electronic Operator
Fan Status	DI	Current Sensitive Relay

16 3.7 BUILDING ELECTRICAL USAGE

- 17 A. Provide digital monitoring of the building KVA and KWH. Coordinate with the
- 18 switchgear manufacturer.
- 19
- 20 B. Electrical Quality monitoring:
- 21 1. Monitor Watts, VA, VAR, Demand, Imbalance, and Power Factor.
- 22
- 23
- 24

25 3.8 MISCELLANEOUS

- 26 A. Freezer/Cooler Temperature Monitoring:
- 27 1. Provide an analog temperature sensor located in the freezer compartment and
- 28 cooler compartment.
- 29
- 30

POINT DESCRIPTION	TYPE	DEVICE
Freezer Alarm	AI	RTD
Cooler Alarm	AI	RTD

- 31 B. Interior Lighting Control:
- 32
- 33
- 34
- 35
- 36
- 37
- 38
- 39
- 40
- 41

Building Management Control System Scope

The lighting control system will be provided with lighting control system BMCS interface devices via DLM room controllers, refer to Electrical Drawings and Details. The BMCS system shall send a occupied and unoccupied signal to the lighting control system BMCS interface devices based on a BMCS schedule.

The BMCS provider shall provide an additional 8 hours of technician support to ensure the lighting control system is commissioned and operating as described.

Lighting Control System Scope

When the Lighting Control system BMCS interface devices in an area receives an occupied signal from BMCS, the lights in that area shall remain in their current state (typically off) but allow any local switch in that area to control the lighting in that space.

When the Lighting Control system receives an unoccupied signal from BMCS, the lighting control system shall flash the lights, and after a delay, the lights in that area shall be swept off by the lighting control system. In this unoccupied mode, the lighting control system shall allow any local light switch in that area to allow the lights to be controlled locally for 2-hours upon being switched on by the local switch. After the 2-hours, the lighting control system enable signal shall expire, and the lights shall again flash a warning, and if the local switch is not again activated, the lights shall be turned off by the lighting control system.

POINT DESCRIPTION	TYPE	DEVICE
Interior Lighting Control		DLM Room Controller

C. Exterior Lighting Control

1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
 - a. Provide separate control of each contactor.
2. The exterior lights shall be controlled by the BMCS using both a combination of photosensor, time schedules and astronomical sunrise/sunset. The exterior lights shall automatically come on when the sun sets based on the longitude and latitude coordinates of the facility (adjustable +/- 30 minutes). At 11 p.m. (adjustable) the time schedule shall turn off the exterior lights. At 4:00 a.m. (adjustable) the exterior lights shall automatically turn on based on time schedule. Upon sunrise, which shall be based on longitude / latitude of the facility the exterior lights shall turn off.
3. Between sunrise and sunset, photo-sensor shall only deactivate all exterior lighting when ambient light levels are above set point (adjustable).

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

D. Photocell: Provide a photo sensor mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

E. Outside Air: Provide a temperature sensor and a humidity sensor to monitor outside air conditions.

POINT DESCRIPTION	TYPE	DEVICE
-------------------	------	--------

POINT DESCRIPTION	TYPE	DEVICE
Outside Temperature	AI	Thermistor
Outside Humidity	AI	Humidity Sensor

- F. Temperature Sensor: Provide a temperature sensor in each MDF, IDF and Control rooms to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
Space Temperature	AI	Space Sensor

- G. Air Conditioning Shutdown Station:

1. Provide an mushroom style momentary push button as indicated on the drawings or as directed by Owner / Architect.
2. Signal the building automation system to enable/disable the operation of the welding room RTU and associated OA RTU (where applicable).
3. Provide an black with white writing phenolic engraved sign above the button with 1/4" tall text to read "BUTTON SHALL BE PRESSED TO DISABLE WELDING ROOM AIR CONDITIONING. AC SHALL BE DISABLED WHEN WELDING EXHAUST FANS ARE ENABLED" Confirm text with owner prior to fabrication.
4. Air conditioning units shall be shut down in an orderly manner so as to not damage the equipment.

3.9 DX ROOFTOP OUTSIDE AIR UNITS

- A. Each roof top unit is furnished with on board controls to operate unit. The BMCS shall provide start / stop control, mode selection, supply air temperature adjustment space temperature and humidity sensors.
- B. Each roof top unit is furnished with BACnet card. Provide full integration and a graphical page that displays all values available with setpoint values that can be modified clearly identified. Hard wired point listed below.
- a. The BMCS shall enable unit to operate in normal operation mode (100% OA), this mode shall be enabled when the building is scheduled to be occupied.
- C. The points listed below shall be hardwired points and not utilize the onboard interface BacNet card.
- D. Additional Space and Humidity Sensors are provided by unit manufacturer to be installed by BMCS contractor.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Space Temperature	AI	Space Thermistor
Space Humidity	AI	Space Humidity Sensor

POINT DESCRIPTION	TYPES	DEVICE
Discharge Air Temperature	AI	Duct Thermistor
Outside Air Temperature	AI	Duct Thermistor
Return Air Temperature	AI	Duct Thermistor
Status	DI	Current Relay
Outside Air Damper	DO	Control Relay
Alarm	DI	Current Relay

3.10 DX ROOFTOP UNITS

- A. Each roof top unit is furnished with on board controls to operate unit. The BMCS shall provide start / stop control, mode selection, supply air temperature adjustment space temperature and humidity sensors.
- B. Each roof top unit is furnished with BACnet card. Provide full integration and a graphical page that displays all values available with setpoint values that can be modified clearly identified. Hard wired point listed below.
- C. The points listed below shall be hardwired points and not utilize the onboard interface BacNet card.
- D. Additional Space and Humidity Sensors are provided by unit manufacturer to be installed by BMCS contractor.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Space Temperature	AI	Space Thermistor
Space Humidity	AI	Space Humidity Sensor
Discharge Air Temperature	AI	Duct Thermistor
Outside Air Temperature	AI	Duct Thermistor
Return Air Temperature	AI	Duct Thermistor
Status	DI	Current Relay
Outside Air Damper	DO	Control Relay
Alarm	DI	Current Relay

3.11 DX VAV ROOFTOP UNITS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

- A. Each roof top unit is furnished with on board controls to operate unit. The BMCS shall provide start / stop control, mode selection, supply air temperature adjustment space temperature and humidity sensors.
- E. Each roof top unit is furnished with BACnet card. Provide full integration and a graphical page that displays all values available with setpoint values that can be modified clearly identified. Hard wired point listed below.
- F. The points listed below shall be hardwired points and not utilize the onboard interface BacNet card.
- G. Additional Space and Humidity Sensors are provided by unit manufacturer to be installed by BMCS contractor.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Space Temperature	AI	Space Thermistor
Space Humidity	AI	Space Humidity Sensor
Discharge Air Temperature	AI	Duct Thermistor
Outside Air Temperature	AI	Duct Thermistor
Return Air Temperature	AI	Duct Thermistor
Status	DI	Current Relay
Outside Air Damper	DO	Control Relay
Alarm	DI	Current Relay

16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33

3.12 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
 - 1. Field panel checkout:
 - a. Verify enclosure is not mounted on vibrating surface.
 - b. Verify class I and class II wiring is separated within enclosure.
 - c. Check for shorts/grounds/induced voltages/proper voltages.
 - d. Verify proper point terminations in accordance with as-builts.
 - e. Verify that all modules are in proper place and addressed.
 - f. Verify proper power voltage.
 - g. Load database and programming.
 - h. Startup the panel.
 - i. Point and device checkout.
 - 2. Analog input point checkout:
 - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.

- b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
 - c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
 - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
 - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
 - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
3. Digital input point checkout:
- a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
 - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
 - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
 - d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
 - e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
4. Digital output point checkout:
- a. Verify that device is correctly wired and terminated as shown in the design documentation package.
 - b. Verify that the correct voltage is utilized in the circuit.
 - c. Verify the point database to be correct (i.e. point name, address, etc.).
 - d. Check and verify that the end device responds appropriately to the digital output(s).
 - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
 - f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate

correctly.

- g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.

5. Analog output point checkout:

- a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
- b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
- c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
- d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
- e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
- f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
- g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
- h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.

6. Terminal equipment controller checkout:

- a. Load program database
- b. Enable programs
- c. Verify sequence of operations

7. Programming checkout:

- a. Provide checkout for each system and sequence of operation.
- b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to meet your specific requirements.
- c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge

- 1 air temperature alarming is operational and is received at the designated
- 2 terminal.
- 3 d. Input to Trigger Test: Change discharge temperature high alarm limit
- 4 through software to a value below the current discharge temperature
- 5 (discharge temperature - 10°F).
- 6 e. Expected Outcome: A high temperature alarm will be received per the
- 7 Alarm Definition Report at its designated terminal.
- 8 f. Provide signoff sheet with indication for test Pass, Fail, Date of test and
- 9 Initials for signoff.
- 10 8. Workstation checkout:
- 11 a. Verify the operation of all trunk interface equipment.
- 12 b. Verify all workstation software, including options, based upon the
- 13 installation instructions for the PC.
- 14 c. Perform software backup (site, options, etc.)
- 15 d. Complete workstation configuration report for owner signoff.
- 16 e. Provide verification that all graphics have been created, as required by
- 17 project bid documents.
- 18

19 3.13 TESTING AND ACCEPTANCE

- 20
- 21 A. General:
- 22 1. After completion of installation and start-up procedures, commence the
- 23 specified 3-phase verification and testing sequence leading to final acceptance.
- 24 a. Follow in the order specified.
- 25 b. Each testing phase shall be satisfactorily completed before entering the
- 26 next phase.
- 27 2. Prior to entering each phase of the sequence, submit for approval, a written
- 28 agenda describing in detail the procedure to be followed to meet the
- 29 requirements for each specified verification, test or demonstration.
- 30 3. Submit for approval, a sample of the form on which the test will be reported.
- 31 a. Identify project.
- 32 b. Provide a list of all points, arrange in numerical order of point
- 33 addresses.
- 34 1) Show point descriptor and location of each.
- 35 2) Indicate DDC panel that processes each point.
- 36 3) Use the list as a basis for the specified report form.
- 37 c. Signatures of participants and observers.
- 38 d. Results.
- 39 e. Description of adjustment or corrections of points in error.
- 40 f. Date.
- 41 4. Provide schedule of tests. Estimate dates of significant events.
- 42 5. Test, calibrate and adjust each point in the system as specified.
- 43 6. Provide documentation of all tests and verifications as specified.
- 44 7. Provide trend reports indicating proper control of all points for an extended
- 45 period of time.
- 46
- 47 B. Phase 1 - Testing, Calibrating, and Adjusting:
- 48 1. Operate each analog point in the entire system.
- 49 a. At a point in the upper quarter of its range.
- 50 b. At a point in the lower quarter of its range.
- 51 c. At its operating point.
- 52 2. Provide personnel and diagnostic instruments at both the central and remote
- 53 locations.
- 54 3. Provide testing stimulants for alarms.
- 55 4. Use digital meters of double the accuracy of the instruments being calibrated.

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
5. Provide an approved test device for simulating high and low temperatures.
 6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
 7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
 8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
 9. Test all power transducers with a Dranetz Power Analyzer.

C. Phase 2 - Equipment and Point Verification:

1. Verify calibration or function of each point.
 - a. Verify analog points at operating value.
 - b. Record on specified form.
 - c. Make approved adjustments to out of tolerance points.
 - 1) Identify these points for ready reference.
2. After verification procedure is completed:
 - a. Verify corrected points.
 - b. Record on specified form.
 - c. Points requiring correction.
 - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.

D. Phase 3 - Software Verification:

1. Submit agenda and report format for software demonstrations.
2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
3. Demonstrate compliance with response time specifications.
 - a. Simulate normal heavy load conditions.
 - b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
04. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.

E. Provide the following reports to Engineer at final completion of all Testing:

1. List of all points.
2. List of all points currently in alarm.
3. List of all disabled points.
4. List of all points in over-ride status.
5. List of all points currently locked out.
6. List of user accounts and access levels.
7. List all weekly schedules.
8. List of holiday programming schedules.
9. List of limits and deadbands.
10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
11. List of programs.
12. Provide trend data reports to ensure proper operation and sequence control of BMCS.

F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.14 TRAINING

A. The contractor shall provide factory-trained instructor to give full instruction to

designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:

Explanation of drawings, operations and maintenance manuals
Walk-through of the job to locate control components
Operator workstation and peripherals
DDC controller and ASC operation/function
Operator control functions including graphic generation and field panel programming
Operation of portable operator's terminal
Explanation of adjustment, calibration and replacement procedures
Student binder with training modules

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.15 PROJECT MANAGEMENT

A. Provide a designated project manager who will be responsible for the following:

1. Construct and maintain project schedule.
2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
3. Attend project meetings as necessary to avoid conflict and delays.
4. Make necessary field decisions relating to this section.
5. Coordination / Single point contact.
6. Have Internet access for project management.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Pipe and Pipe Fittings
 - 2. Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

- A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.
- B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

- A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.
- B. Use valves with a bronze body and sweat-type connections.
- C. Provide stainless steel stem and plunger assembly and a stainless steel piston.
- D. Furnish sealed and moisture proof solenoid coils.
- E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

- A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

- A. Furnish replaceable core liquid line filter dryer.
- B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

1
2 PART 3 - EXECUTION
3

4 3.1 BRAZING
5

- 6 A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent
7 oxides from forming.
8

9 3.2 PRESSURE TEST
10

- 11 A. After refrigeration and piping system items are installed, charge the system with dry
12 nitrogen and test to 450 psig.
13 1. Test joints with a Halide torch or an electronic leak detector.
14 2. Repair leaks and retest each system until proved tight.
15

16 3.3 EVACUATION AND DRYING
17

- 18 A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and
19 evacuate piping system, including lines and equipment.
20 1. Maintain a vacuum as high as practicable for long enough to evaporate the
21 moisture in the system (at least 48 hours).
22 2. Check the humidity within the system with a wet bulb indicator, and maintain
23 the vacuum until the wet bulb temperature is reduced to -40°F. After the system
24 has been evacuated and dried, break the vacuum by charging proper refrigerant
25 into the system.
26

27 3.4 PIPE SIZE
28

- 29 A. Pipe shall be routed and sized per condensing unit manufacturer's instructions.
30
31

END OF SECTION

SECTION 23 31 13

DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

- A. Division 23 Mechanical
 1. Air Devices
 2. Insulation
 3. Fans
 4. Packaged Rooftop Air Conditioners
 5. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.4 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.

- 1
2 B. Submit product data and sealing materials to be used.
3
4 C. Submit sound attenuation data.
5
6 D. Submit shop drawings in plan, elevation and sections, and three-dimensional view
7 showing equipment in mechanical equipment areas.
8
- 9 PART 2 - PRODUCTS
- 10
11 2.1 STANDARDS AND CODES
12
13 A. Except as otherwise indicated, sheet metal ductwork material and installation shall
14 comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air
15 distribution devices (such as dampers) included in this specification shall comply with the
16 latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for
17 HVAC Systems and NFPA 90A.
18
- 19 2.2 DUCT MATERIAL AND CONSTRUCTION
20
21 A. Except for the special ducts specified below use lock forming quality prime galvanized
22 steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's
23 name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's
24 name. Provide certification of duct gauge and manufacturer for each size duct.
25
26 B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with
27 the latest edition of SMACNA HVAC Duct Construction Standards.
28
29 C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam
30 SMACNA Type RL-1. Fittings shall be welded construction.
31 1. Galvanized
32 2. Stainless Steel
33 3. Aluminum
34 4. Paint Grip
35 5. Perforated
36
37 D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams.
38 Ducts shall be constructed for a minimum of 2" w.g. static pressure.
39
40 E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.
41
42 F. Shower Area Exhaust Systems: Welded 304 Stainless steel.
43
44 G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge
45
46 H. Natatorium Ductwork: 304 Stainless Steel
47
- 48 2.3 ACOUSTICAL DUCT
49
50 A. Duct and fittings:
51 1. Double wall acoustically treated.
52 2. Annular space packed with fiberglass insulation.
53 3. Perforated metal liner to provide specific acoustic impedance
54 4. Insulation 1.0 pcf. 1 inch thick
55 5. United McGill Acousti-K27 spiral lockseam or approved equal
56 6. Material as indicated below:

- 1 a. Paintable Galvanized Steel
- 2
- 3 B. Pressure rating and tests as specified for single wall ductwork.
- 4
- 5 2.4 WELDING EXHAUST DUCTWORK (INDOORS)
- 6
- 7 A. Tapered welded galvanized duct system.
- 8
- 9 B. Construct according to the Industrial Ventilation Manual.
- 10
- 11 2.5 WELDING EXHAUST DUCTWORK (OUTDOORS)
- 12
- 13 A. Ductwork outdoors welded watertight.
- 14 1. Coat welded areas with cold galvanizing compound.
- 15
- 16 B. Paint with two coats of industrial fume resistant enamel.
- 17 1. Galvanize prime coat.
- 18
- 19 C. Construct according to the Industrial Ventilation Manual.
- 20
- 21 2.6 DUCT SEALING OF SEAMS AND JOINTS
- 22
- 23 A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT
- 24 LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and
- 25 transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and
- 26 non-migrating elastomeric sealant. With the exception of continuously welded joints and
- 27 machine made spiral lock seams, joints and seams made air tight with duct sealer.
- 28 1. Indoor applications – Foster 32-14
- 29 2. Outdoor applications – Foster 32-17
- 30
- 31 2.7 FLEXIBLE DUCT LOW PRESSURE
- 32
- 33 A. Construction:
- 34 1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
- 35 a. The fabric shall be mechanically fastened to the steel helix without the
- 36 use of adhesives.
- 37 2. UL 181 Class I air duct label
- 38 3. Reinforced vapor barrier jacket
- 39 4. Rated for use at system pressure (6" wc minimum)
- 40 5. Flexible duct connections from lateral taps to variable volume boxes or terminal
- 41 boxes shall be rated at twice the maximum pressure rating of the medium
- 42 pressure system.
- 43
- 44 B. Fire hazard classification:
- 45 1. Flame spread rating 25 maximum.
- 46 2. Smoke developed rating 50 maximum.
- 47
- 48 C. Thermal characteristics:
- 49 1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
- 50 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
- 51 3. 2" minimum wall thickness insulation with 1" overlap
- 52
- 53 D. Acceptable manufacturers:
- 54 1. Flexmaster
- 55 2. Hart & Cooley
- 56 3. Omniair

4. Peppertree Air Solutions

2.8 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

- A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
- B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:
Positive: 12" w.g.
Negative: 5" w.g.
- C. The duct shall be rated for a velocity of at least 5500 fpm.
- D. Suitable for operating temperature range of -20°F to +250°F.
- E. Factory insulate the flexible duct with fiberglass insulation.
 - 1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 - 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 - 3. 2" minimum wall thickness insulation with 1" overlap
- F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.
- G. Acceptable manufacturers:
 - 1. Flexmaster
 - 2. Omniair
 - 3. Peppertree Air Solutions

2.9 FIRE DAMPERS

- A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.
- B. Acceptable Manufacturers:
 - 1. Ruskin
 - 2. Prefco Products
 - 3. Air Balance
 - 4. Greenheck, Inc.
 - 5. Nailor Industries
 - 6. Pottoroff

2.10 WALL LOUVERS

- A. Refer to schedule on drawings. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.

- 1
2 D. Louvers shall be AMCA-550 tested and approved.
3
4 E. Acceptable manufacturers:
5 1. American Warming and Ventilation
6 2. Arrow
7 3. Greenheck
8 4. NCA
9 5. Pottorff
10 6. Ruskin
11
12 2.11 DUCT LINING
13
14 A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream
15 side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or
16 equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.
17
18 2.12 VOLUME DAMPERS
19
20 A. Manual balancing dampers that meet or exceed the following minimum construction
21 standards:
22 1. Frame 16-gauge
23 2. Blades 16-gauge
24 3. Bearings corrosion resistant
25 4. Concealed linkage
26 5. Opposed blade dampers
27
28 B. Acceptable manufacturer:
29 1. Ruskin Model MD-35 or approved equal, by
30 2. Arrow
31 3. American Warming and Ventilating
32 4. Nailor Industries
33 5. Pottorff
34
35 2.13 ACCESS DOORS
36
37 A. Round spin-in door of galvanized steel.
38 1. Fire proof sealing gaskets and quick fastening locking devices
39 2. Insulated door
40 3. Conform to the requirements of the NFPA
41 4. Identification and use of each access door
42 5. UL label to match the construction in which it is installed
43 6. Cable attached to door and outer frame
44 7. Low leakage Access Door
45
46 B. Acceptable Manufacturer
47 1. Flex master, Inspector Series
48 2. Approved Equal
49
50 2.14 COMBINATION FIRE/SMOKE DAMPERS
51
52 A. Combination fire/smoke dampers meeting the following requirements:
53 1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL
54 Standard 555, 4th Edition, and shall be further classified by Underwriters
55 Laboratories as a leakage Rated Damper for use in smoke control systems under
56 the latest version of UL555S, and bear a UL label attesting to same. The damper

- 1 manufacturer shall have tested, and qualified with UL, a complete range of
2 damper sizes covering all dampers required by this specification. Testing and
3 qualifying a single damper size is not acceptable. The leakage rating under
4 UL555S shall be Leakage Class II.
- 5 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed
6 into a structural hat channel shape with tabbed corners for reinforcement, as
7 approved in testing by Underwriters Laboratories. Bearings shall be integral
8 high surface area non-electrolytic materials construction to incorporate a friction
9 free frame blade lap seal, or molybdenum disulfide impregnated stainless steel
10 or bronze oilite sleeve type turning in the damper frame. The dampers shall be
11 opposed blade type. The blades shall be constructed with a minimum of 16-
12 gauge galvanized steel. The blade edge seal material shall be able to withstand
13 450°F. The jamb seals shall be flexible stainless steel compression type.
- 14 3. As part of the UL qualification, dampers shall have demonstrated a capacity to
15 operate (open and close) under HVAC system operation conditions, with
16 pressures of at least 4" water gauge in the closed position, and 2,000 fpm air
17 velocity in the open position.
- 18 4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15
19 second heat-actuated release device. The electric EFL shall close and lock the
20 fire/smoke damper during test, smoke detection, power failure or fire conditions
21 through actuator closure springs. To prevent duct and HVAC component
22 damage, the damper shall at all times be connected to the actuator for controlled
23 closure in not less than 7 seconds and no more than 15 seconds. Instantaneous
24 damper closure is unacceptable. After exposure to high temperature of fire, the
25 damper must be inspected prior to reset to ensure proper operation. Release
26 temperature is 165°F.
- 27 5. Provide UL555S qualified electric actuator at 120 VAC.
- 28 6. Provide air-foil type blades.
- 29
- 30 B. Provide integral sleeves
- 31
- 32 C. Acceptable Manufacturers:
- 33 1. Ruskin
- 34 2. Air Balance, Inc.
- 35 3. Greenheck, Inc.
- 36 4. Nailor Industries
- 37 5. Pottoroff
- 38

39 2.15 SMOKE DAMPERS

- 40
- 41 A. Smoke dampers meeting the following requirements.
- 42 1. Each smoke damper shall be classified by Underwriters Laboratories as a
43 leakage Rated Damper for use in smoke control systems under the latest version
44 of UL555S, and bear a UL label attesting to same. The damper manufacturer
45 shall have tested, and qualified with UL, a complete range of damper sizes
46 covering all dampers required by this specification. Testing and qualifying a
47 single damper size is not acceptable. The leakage rating under UL555S shall be
48 Leakage Class II.
- 49 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed
50 into a structural hat channel shape with tabbed corners for reinforcement, as
51 approved in testing by Underwriters Laboratories. Bearings shall be integral
52 high surface area non-electrolytic materials construction to incorporate a friction
53 free frame blade lap seal, or molybdenum disulfide impregnated stainless steel
54 or bronze oilite sleeve type turning in the damper frame. The dampers shall be
55 opposed blade type. The blades shall be constructed with a minimum of 16
56 gauge, galvanized steel. The blade edge seal material shall be able to withstand

- 1 450°F. The jamb seals shall be flexible stainless steel compression type.
- 2 3. As part of the UL qualification, dampers shall have demonstrated a capacity to
- 3 operate (open and close) under HVAC system operation conditions, with
- 4 pressures of at least 4" water gauge in the closed position, and 2,000 fpm air
- 5 velocity in the open position.
- 6 4. Provide UL555S qualified electric actuator at 120 VAC.
- 7 5. Provide air-foil type blades.
- 8
- 9 B. Provide integral sleeves.
- 10
- 11 C. Acceptable Manufacturers:
- 12 1. Ruskin
- 13 2. Air Balance, Inc.
- 14 3. Greenheck, Inc.
- 15 4. Nailor Industries
- 16 5. Pottoroff
- 17
- 18 2.16 DIFFUSER FITTINGS LOW PRESSURE TAPS
- 19
- 20 A. Fitting shall meet or exceed the following minimum construction standards:
- 21 1. Conical with a base diameter two inches larger than the tap diameter.
- 22 2. Construct fitting and damper of galvanized steel in accordance with ASTM A
- 23 527, G90 finish.
- 24 a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches
- 25 from the discharge end of the fitting
- 26 b. Provide the fitting with a butterfly damper, damper rod, end bearings
- 27 and heavy duty locking quadrant.
- 28 c. Size the length of the straight section of the fitting to match the damper
- 29 blade diameter. Center the damper blade in the straight section.
- 30 3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
- 31 a. Through 8 inches: 26 gauge; Damper blade 22 gauge
- 32 b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
- 33 c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
- 34 d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
- 35 4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2)
- 36 galvanized U-bolts.
- 37 5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
- 38 6. Provide the damper with a self-locking regulator and handle.
- 39 7. Provide a 2" sheet metal stand-off to extend the regulator.
- 40 8. Flex duct grip area – 2 inches behind retaining bead
- 41 9. Flex duct retaining bead – 1 inch from end
- 42 10. Conical length of at least 3 inches
- 43 11. Barrel length of at least 9 inches
- 44
- 45 2.17 AUXILIARY DRAIN PANS
- 46
- 47 A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same
- 48 dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be
- 49 large enough to complete cover drip lines of unit.
- 50
- 51 2.18 DUCTWORK SUPPORTS ON ROOF
- 52
- 53 A. Support ductwork on roof with Portable Pipe Hanger Model PHP-D fully adjustable
- 54 height and width. Base material shall be high density / high impact polypropylene with
- 55 UV inhibitors and anti-oxidants. Provide with hot dip galvanized framing. Nuts and
- 56 washers shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
- H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
- I. Install end bearing at all location where damper shaft penetrates duct wall.
- J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.
- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18"

1 wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage
2 duct liner if specified during operation.

- 3 1. Construct shop manufactured scoops and splitter blades of galvanized sheet
4 metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up
5 to 16 gauge).
- 6 2. Check extractors, scoops and splitter blades thoroughly for freedom of
7 operation. Oil bearing points before installing.

8
9 E. Use pushrod operator with locking nut and butt hinges assembly.

10
11 F. Provide opposed-blade volume dampers with an appropriate control device in each of the
12 following locations:

- 13 1. Return air ductwork
- 14 2. Outside air branch duct
- 15 3. Exhaust branch duct
- 16 4. Exhaust connections to hoods except kitchen grease hoods or equipment
- 17 5. In each zone at multi-zone unit discharge installed downstream of duct mounted
18 re-heat coils
- 19 6. At each outside air and return air duct connection to plenum of constant volume
20 units
- 21 7. At discharge side of constant volume boxes
- 22 8. Where otherwise indicated or required for balancing coordinate location of
23 additional dampers required by TAB Contractor.
- 24 9. Provide multi-blade dampers when blade width exceeds 12". Provide end
25 bearing where damper shaft penetrates duct wall.

26
27 G. Elbows:

- 28 1. Rectangular: Where square elbows are shown, or are required for good airflow,
29 provide and install single-wall or airfoil turning vanes. Job-fabricated turning
30 vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the
31 same gauge metal as the duct in which they are installed. Furnish vanes
32 fabricated for the same angle as the duct offset. The use of radius elbows with a
33 centerline radius of not less than 1-1/2 times the duct width may be provided in
34 lieu of vaned elbows where space and air flow requirements permit.
- 35 2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the
36 duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece,
37 90° elbows and 3 piece, 45° elbows.

38
39 H. For control devices concealed by ceilings, furring, or in other inaccessible locations,
40 furnish extension rods and appropriate recessed-type Young regulators, mounted on the
41 surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with
42 chrome plated cover plates. Use only one mitered gear set for each control device.

43
44 I. Install streamline deflectors at any point where dividing a sheet metal duct around piping
45 or where other such obstruction is permitted. Where such obstructions occur in insulated
46 ducts, fill space inside streamliner and around obstructions with glass fiber insulation.

47
48 J. Insulated Flexible Duct:

- 49 1. Install in accordance with manufacturer's instructions, and the terms of its UL
50 listing. Duct shall not exceed 6' in length. Make connections by use of sheet
51 metal collars and stainless steel circular screw clamps. Clamps shall encircle the
52 duct completely and be tightened with a worm gear operator to the point that
53 will provide an airtight connection without unnecessary deformation of the duct.
54 Provide one clamp on flexible duct and one clamp on external insulation. Vapor
55 barrier jacket shall be tucked inside to conceal insulation material.
- 56 2. Construct bends over 45° with sheet metal elbows.

- K. Duct Supports:
1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
 2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
 3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
 4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

- L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

3.3 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
1. Fire Dampers
 2. Smoke Dampers
 3. Smoke/fire Dampers
 4. Outside Air Dampers
 5. Duct Mounted Coils (up-stream)
 6. Control Dampers
- B. Size access door 1" smaller than ductwork.

1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.
- 3.6 DUCT LINING
- A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
- B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.
- C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.
- D. Do not install liner in multi-zone unit ductwork.
- 3.7 SEALING OF SEAMS AND JOINTS
- A. Seal supply, return, exhaust and outside air duct systems.
- 3.8 FLUES
- A. Provide and install flues for all gas fired equipment.
- B. Refer to plans for all related locations.
- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.
- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.
- E. Terminate flues at height above roof to prevent flue gas from entering the building.
- 3.9 ACOUSTICAL DUCT
- A. Install in the following locations:
1. Where indicated on the drawings
- 3.10 SCREENS
- A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

1 3.11 CONNECTIONS TO LOUVERS

- 2
- 3 A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight
- 4 soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to
- 5 be over bottom louver blade where possible.
- 6
- 7 B. Where plenums are installed on inside of louver, construct such that bottom of plenum
- 8 will lap over bottom blade of louver to drain any water that may enter.
- 9

10 3.12 PLENUMS

- 11
- 12 A. Construct plenums with galvanized steel framing members and galvanized sheet steel,
- 13 cross broken and rigidly braced with galvanized angles. Gauges and bracing shall
- 14 conform to SMACNA recommendations for ductwork of like sizes. Openings for fans,
- 15 access doors, etc., shall be framed with galvanized steel angles.
- 16
- 17 B. Provide access doors.
- 18

19 3.13 AUXILIARY DRAIN PANS

- 20
- 21 A. Where coils that have a condensate drain are located above ceiling.
- 22

23 3.14 TESTING OF LOW PRESSURE DUCTWORK

- 24
- 25 A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total
- 26 airflow.
- 27
- 28 B. Provide equipment necessary for performing tests, including rotary blower large enough
- 29 to provide required static pressure at allowed CFM quantity, certified orifice section with
- 30 proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube
- 31 gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- 32
- 33 C. Mains: Test mains after risers and branches are tied in and all equipment set. Close
- 34 runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times
- 35 design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release
- 36 mains for completion after joints are tight.
- 37
- 38 D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be
- 39 visually inspected.
- 40

41 3.15 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

- 42
- 43 A. As the project progresses, test the ductwork in sections.
- 44
- 45 B. Provide equipment necessary for performing tests, including rotary blower large enough
- 46 to provide required static pressure at allowed CFM quantity, certified orifice section with
- 47 proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube
- 48 gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- 49
- 50 C. Finally as a complete system, test ductwork at a minimum of 2.5" with a maximum
- 51 allowable leakage of 1% of the total design supply airflow.
- 52
- 53 D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".
- 54
- 55

END OF SECTION

SECTION 23 34 16

FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

- A. Division 23 Mechanical:
1. Ductwork
 2. Vibration Isolation
 3. Air Balance
 4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.
- E. Fans shall be capable of 120% of the scheduled air capacities.
- F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.4 SUBMITTALS

- A. Submit fan performance curves with system operating point plotted on curves.
- B. Submit manufacturer's printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cook
- B. Greenheck
- C. Penn Barry Ventilator
- D. Twin City Fans

2.2 PROTECTIVE COATINGS

- A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.
- B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.3 SUPPLEMENTAL EQUIPMENT

- A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.
- B. Belt Drives:
 - 1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
 - 2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
 - 3. Provide belt guards and apply the same finish as used on the fan.
 - 4. Oil and heat resistant, nonstatic type belts.
 - 5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.
- C. Direct Drive:
 - 1. Unless otherwise specified for direct-driven fans, equip the electrically commutated fan motor with unit mounted fan speed controller including leads for connection 0-10 VDC external controller.
 - 2. Where fan is specified to operate at two setpoints, provide a 2 speed controller. Controller shall be equipped with two speed dials individually set 0-10 V signals provided by external controllers. Controller shall be equipped with an internal transformer, A-B-Stop-Auto switch and terminals for connecting EC motors and controls.
- D. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.
- E. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.
- F. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.
- G. Where motorized damper is scheduled:

1. The motor and damper are specified in the Building Management and Control System Specification.
- H. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
1. Fan mark as indicated on the Contract Drawings.
 2. Serial number
 3. Model number
 4. Capacity (CFM) and static pressure.
 5. Motor HP
 6. Motor Amps
 7. Manufacturer
 8. Motor phase
 9. Number of Belts/Make/Size
 10. Motor volts
- I. Utility Vent Set Fans, provide minimum ¾ inch threaded coupling drain connection at lowest point of housing.
- 2.4 VENTILATION AND EXHAUST FANS
- A. Provide the ventilation and exhaust fans shown on the drawings.
 - B. Provide each motor with internal overload protection.
 - C. Provide each belt driven fan with approved, totally enclosed belt guard.
 - D. Provide approved safety screen where inlet or outlet is exposed.
 - E. Provide duct flanges where required for connections.
 - F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
 - G. Furnish supply fans with 1" aluminum, washable filter section.
- 2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS
- A. Provide the rooftop ventilation and exhaust systems shown on the drawings.
 - B. Provide each motor with internal overload protection.
 - C. Components:
 1. Aluminum, stainless steel or plastic coated bird guard.
 2. Screws and fasteners of stainless steel or nonferrous material.
 3. All aluminum construction unless indicated otherwise on fan schedule.
 - D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine allow aluminum.
 - E. Aluminum base shall be continuously welded curb cap corners.
- 2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS
- A. Provide the rooftop intake and relief vent systems shown on the drawings.

- B. Provide with aluminum, stainless steel or plastic coated bird guard.
 - 1. Screws and fasteners of stainless steel or nonferrous material
 - 2. All aluminum construction
 - C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
 - D. Aluminum base shall be continuously welded curb cap corners.
- 2.7 OSCILLATING AIR CIRCULATOR FAN
- A. three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100
 - B. Totally enclosed motor voltage – 120 Voltage – 60 Hz
 - C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard
 - D. Wall Mounted
 - E. Factory wired 10', 3 conductor with ground molded plug
 - F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.
- B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
- C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x 1/4" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.
- D. Install curbs and equipment in level position.
- E. Ceiling mounted in-line centrifugal blowers
 - 1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
 - 2. Provide sub-structure where required.
 - 3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.2 EXTRA MATERIALS

- A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION

SECTION 23 34 18

INDUSTRIAL HIGH VOLUME LOW SPEED FANS (DIRECT DRIVE)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install an Industrial High Volume Low Speed (HVLS) ceiling mounted fans with supplemental equipment.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Building Management and Control System
 - 2. Air Balance
 - 3. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating air volume variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Fans with sound ratings shall be below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.

1.4 SUBMITTALS

- A. Submit fan drawings detailing product dimensions, weight, structural supporting points and attachment methods.
- B. Submit product specification sheets on the ceiling mounted fan, specifying electrical and installation requirements, features, and benefits and controller information.
- C. Submit manufacturer's installation instructions and operation and maintenance instructions.
- D. Submit documentation illustrating fan sizing, placement and performance was verified using computational fluid dynamics (CFD) analysis. Documentation shall include all input data used for CFD analysis including significant obstructions to airflow at the floor level and the actual space dimensions. Submittal shall also include results of the CFD analysis.
- E. Submit all warranty information including a list of each component's warranty coverage.
- F. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1 1.5 STORAGE/HANDLING/SHIPPING

- 2
- 3 A. Comply with manufacturer's installation instructions for rigging, unloading, and
- 4 transporting units.
- 5
- 6 B. Protect units from physical damage. Deliver product in original, undamaged packaging
- 7 with identification labels intact. The fan shall be new, free from defects and factory
- 8 tested.
- 9
- 10 C. The fan, fan components and accessories shall be stored in a safe, dry location until
- 11 installation.
- 12

13 1.6 WARRANTY

- 14
- 15 A. The manufacturer shall replace any products or components defective in material or
- 16 workmanship, free of charge to the customer (including transportation charges) in
- 17 accordance to the following schedule.

Mechanical	15 years
Electrical	7 years
Labor	1 year

18

19 PART 2 - PRODUCTS

20

21 2.1 ACCEPTABLE MANUFACTURERS

- 22
- 23 A. Big Ass Fans – Powerfoil D
- 24
- 25 B. Greenheck – Amplify DS-6
- 26
- 27 B. MacroAire - AVDX
- 28

29 2.2 HIGH VOLUME, LOW SPEED FANS (DIRECT DRIVE)

- 30
- 31 A. Complete Unit: The fan shall be NRTL certified and built pursuant to construction
- 32 guidelines set forth by UL Standard 507 and CSA Standard 22.2. The fan controller shall
- 33 be compliant with FCC rules to not cause harmful interference and accept and
- 34 interference received. The fan shall be designed to move an effective amount of air and
- 35 provide destratification in in a variety of applications with dense floor obstructions, over
- 36 an extended life. The fan and components shall be designed specifically for high volume,
- 37 low speed fans to ensure lower operational noise. The sound levels from the fan operating
- 38 at maximum speed measured in a laboratory setting shall not exceed 55 dBA.
- 39
- 40 B. Onboard Fan Control: The fan shall be equipped with an onboard fan controller which
- 41 utilizes a variable frequency drive (VFD) that is prewired to the motor and factory
- 42 programmed to minimize the starting and braking torques.
- 43
- 44 C. Airfoil System: The fan shall be equipped with six (6) airfoils of precision extruded
- 45 aluminum alloy. The airfoils shall be connected by means of two (2) locking bolts per
- 46 airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel
- 47 retainers. Airfoils shall be powder coated with color per Architect. The fan shall be
- 48 equipped with six (6) airfoil winglets on the ends of the airfoils. The winglets shall be
- 49 molded of high density polyethylene. Winglets shall be “Safety Yellow,” but may be
- 50 colored as specified by the Architect or Owner.
- 51
- 52 D. Motor: The fan motor shall be permanent magnet brushless motor rated for continuous
- 53 operation at maximum speed with the capability of modulating from 0%-100% without

the use of a gearbox. The motor shall be totally enclosed IP66 rated. The motor frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F minimum insulation and be capable of continuous operation in -4°F to 131°F ambient conditions. The motor shall operate from any voltage rang, single phase of three phase without adapters or customer selection.

- E. Mounting Post: The fan shall be equipped with a mounting post that provides a structural connection between the fan assembly and extension tube. The mounting post shall be formed from A36 steel, contain no critical welds and be powder coated for corrosion resistance and appearance. Mounting post color shall be per Architect.
- F. Hub: The fan hub shall be precision cut aluminum for high strength and light weight. The hub design shall provide flexible assembly to distribute force loads experienced by the hub assembly over a large area to reduce fatigue experienced at the attachment point for the fan blade. The hub shall be secured to the output shaft of the motor by means of one aerospace grade lug nut. The hub shall incorporate a minimum of six (6) safety retaining clips made of 1/4" thick steel that shall restrain the hub/airfoil assembly.
- H. Mounting System: The fan mounting system shall be designed for quick and secure installation to a variety of structural support types. The mounting system shall accommodate adjustments after fan installation via two axes of rotation to ensure fan will hang level from structure. All components in the mounting system shall be welded construction using low carbon steel no less than 3/16" thick and be powder coated for appearance and resistance to corrosion. All mounting bolts shall be SAE Grade 8 or equivalent and rated with a minimum tensile strength of 150,000 psi. Mounting components color shall be per Architect.
- I. Safety Cable: The fan shall be equipped with an upper safety cable that provides additional means of securing the fan assembly to the building structure. The safety cable shall be 3/8" diameter and fabricated of 7x19 stranded galvanized steel. The loops shall be secured with swaged Nicopress fittings, pre-loaded and tested to 3,200 lbf. Field construction of safety cables shall not be permitted.
- J. Wall Control Controller (Single Fan) as noted on the equipment schedule: Each fan shall be provided with an intuitive LED touchscreen wall mounted interface controller. The controller shall be IP55 rated and mount to a standard single or duplex outlet box. Controller shall be provided with a 150' CAT5 cable for connecting the controller to the fan's VFD and provide power to controller. Fan start/stop, speed, fan direction control, diagnostic, fault history, ability to configure fan parameters shall be available through the wall mounted controller. All wall controller adjustments shall be password protected to prevent unauthorized access to settings.
- J. Wall Mounted Controller (Multiple Fans) as noted on the equipment schedule: Each group of four HVLS fans shall be provided with a single intuitive LED touchscreen wall mounted interface controller that is capable of controlling each fan individually or a group of fans simultaneously. The controller shall mount to a standard single or duplex outlet box. Controller shall be provided with a 150' CAT5 cables for each fan to allow seamless communication between the wall controller and each fan's VFD. The CAT5 cable shall provide power to the digital controller and not require an additional power source. Fan start/stop, speed, fan direction control, diagnostic, fault history, ability to configure fan parameters and fan scheduling shall be available through the wall mounted controller. In addition, the controller shall also include logic to automatically control the speed of the HVLS fan in response to the controller's onboard temperature and humidity sensors. The digital controller shall also be BacNet compatible and equipped with Bluetooth functionality. All wall controller adjustments shall be password protected to prevent unauthorized access to settings.

1
2 L. Fire Control Panel Integration: Includes a 10–30 VDC pilot relay for seamless fire
3 control panel integration. The pilot relay can be wired Normally Open or Normally
4 Closed in the field.

5
6 M. Guy Wires: Provide guy wires to limit the potential for lateral movement.
7

8 PART 3 – EXECUTION 9

10 3.1 INSTALLATION 11

- 12 A. The fan shall be installed by a factory certified installer in accordance with
13 manufacturer's installation instruction.
14
15 B. Fan location shall be free from obstacles such as lights, cables or other building
16 components and have bar joists or I-beam structure to mount fan and be capable of
17 supporting fan weight and fan operational torque. A structural engineer shall be consulted
18 for installation methods outside the manufacturer's recommendation and a certification
19 submitted prior to installation.
20
21 C. The fan shall be installed so that the airfoils are a minimum of 10' above the floor. The
22 fan installation area must be free of obstructions such as lights, cables, sprinklers or other
23 building structures; with the airfoils at least 2' clear of all obstructions. The fan should
24 not be installed where it will be continuously subjected to wind gusts or in close
25 proximity to the outputs of HVAC systems.
26
27 D. The fan controller shall be mounted to a flat, readily accessible surface that is free from
28 vibration and away from foreign objects and moving equipment. mounting location shall
29 meet all accessibility requirements.
30
31 E. In buildings equipped with sprinklers, including ESFR sprinklers, fan installation shall
32 comply with all of the following:
33 1. The maximum fan diameter shall be 24 ft (7.3 m).
34 2. The HVLS fan shall be centered approximately between four adjacent
35 sprinklers.
36 3. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a
37 minimum of 3 ft (0.9 m).
38 4. All HVLS fans shall be interlocked to shut down immediately upon receiving a
39 waterflow signal from the alarm system in accordance with the requirements of
40 NFPA 72—National Fire Alarm and Signaling Code.
41

42 3.2 WORKMANSHIP 43

- 44 A. Good workmanship shall be evident in all aspects of construction and installation. Field
45 balancing of the airfoils shall not be necessary.
46

47
END OF SECTION

SECTION 23 36 16

VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install variable volume terminal units, including hangers, controls and other required elements.
 - 1. Provide constant fan variable volume terminal units where indicated on the drawings.
 - 2. Provide variable volume terminal units where indicated on the drawings.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical Requirements for Mechanical Work.
 - 4. Building Management and Control System.
 - 5. Vibration Isolation,

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.
- B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

1.4 SUBMITTALS

- A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order. Submit internal wiring diagrams, installation and operation manual as a complete submittal package.
- B. Submit certified sound power levels for both discharge sound and casing radiated sound in accordance with ARI 880-98 Certification Program. All NC levels shall be calculated using ARI 885-98, Appendix E attenuation factors for mineral ceiling.
- C. Submit for each box the following information:
 - 1. Box size
 - 2. Inlet size
 - 3. Box number
 - 4. Box designation
 - 5. Minimum / Maximum Fan CFM
 - 6. L / R Coil connection
 - 7. GPM
 - 8. Motor HP
 - 9. NC Level
 - 10. External Static Pressure
 - 11. Scheduled MBH
 - 12. Actual MBH
 - 13. Heating Coil Pressure Drop (ft.)
 - 14. Entering and Leaving Water Temperature

VARIABLE VOLUME TERMINAL UNITS

15. Entering and Leaving Air Temperature

1.5 QUALITY ASSURANCE.

- A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.
- B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.
- C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Titus.
- B. Krueger
- C. Price
- D. Nailor
- E. Metalaire

2.2 BOX CONSTRUCTION

- A. Galvanized 22-gauge steel casing with suspension lugs.
- B. Lined with minimum 1.5 PCF / 1" thick fiber free
 - 1. Flame spread not higher than 25.
 - 2. Smoke developed rating not higher than 50.
 - 3. Condensation on the exterior of the box is not approved.
 - 4. Coat all cut edges of liner with NFPA approved sealant.
 - 5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.
- C. Provide access to controls, fan compartment, and unit servicing, without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.
- D. Components shall be constructed of corrosion resistant materials.
- E. Bearings shall not require lubrication.
- F. Casing leakage shall not exceed 2.0% of scheduled design air flow at 3.0" WG interior casing pressure.
- G. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.
- H. The maximum overall height of the variable air volume unit shall not exceed available ceiling space.
- I. Maximum static pressure drop of air through terminal box shall be 0.2" w.g.

- 1
2 J. Maximum velocity through duct inlet shall be 2,000 fpm.
3
4 2.3 COMPONENTS
5
6 A. The entire terminal unit, including the heating coil, shall be designed and built as a single unit.
7
8 B. Provide each unit with a primary variable air volume damper that controls the air quantity in
9 response to a space sensor.
10
11 C. Each unit shall contain:
12 1. Fan and motor assembly. For Fan Powered Units Only
13 2. Heating coil.
14
15 D. Locate the heating coil in the discharge of the blower section.
16
17 E. Provide single point electrical connections for the entire unit. Entire assembly shall be UL or
18 ETL Certified, electrical components shall be UL listed and installed in accordance with the
19 National Electrical Code.
20
21 F. The variable air volume units provided by the manufacturer shall be the quietest design
22 available from the manufacturer for the type specified.
23
24 G. Induced air filter frame for 1" thick disposable filter.
25
26 H. Sufficient power for the VAV unit DDC controller, electric actuator and other components
27 necessary to satisfy the sequence of operation. Size each transformer for the total connected
28 load plus an additional 25% of the connected load. Primary and secondary fuses housed in a
29 fuse block.
30
31 I. Inlet attenuator for induction airside of box with liner to lower radiated noise.
32
33 2.4 BLOWER FAN AND MOTOR
34
35 A. Blower fan:
36 1. Constructed of steel.
37 2. Forward curved centrifugal wheel.
38 3. Dynamically balanced wheels.
39 4. Direct drive motors.
40
41 B. Motor
42 1. Ultra-high efficiency ECM motor technology
43
44 C. Motor current characteristics as scheduled. Coordinate motor voltage with Division 26. Verify
45 voltage with Electrical Plans.
46 1. Thermal overload protection.
47 2. Sleeve bearings.
48
49 D. Provide isolation between fan motor assembly and unit casing.
50
51 E. Provide a manual speed control system to allow continuously adjustable fan speed from
52 maximum to minimum.
53 1. Electronic speed control matched to operate with the motor.
54 2. Speed controller shall incorporate a minimum voltage stop to ensure motor cannot
55 operate in a stall mode.
56

1 F. Fan disconnect switch. This is not to be used as a main disconnect switch.

2
3 G. Provide electric heating models with the following items:

- 4 1. Single point electrical connection
- 5 2. Line side disconnect switch
- 6 3. Motor fuse
- 7 4. Motor disconnect switch
- 8 5. Fan SCR and relay
- 9 6. Control transformer
- 10 7. Air flow switch
- 11 8. Heat contactors
- 12 9. Thermal Hi-Limit Auto Reset switch

13
14 2.5 PRIMARY AIR DAMPER AND ACTUATOR

15
16 A. The control actuator shall vary the primary air damper in response to the control signal.

- 17 1. Damper leakage at shutoff shall not exceed 2.0% at 1" WG pressure.
- 18 2. Locate the damper inside the unit.
- 19 3. Damper connection to the operating shaft shall be a positive mechanical connection.
- 20 4. Damper shall have bearings at all penetrations of inlet tube and terminal housing.
21 Penetration of damper shaft in terminal lining shall have seal at surface of lining to
22 prevent fiber entrainment through rotation of damper shaft.
- 23 5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate
24 beyond full closed position. One pin shall ensure damper cannot rotate beyond full
25 open position.
- 26 6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow
27 sensor tubing to provide stop point for hard duct and anchor point for flex duct.
- 28 7. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
- 29 8. Flow sensor shall be center averaging type. Non-center averaging flow sensors are
30 not acceptable.

31
32 2.6 AIR FLOW CONTROL

33
34 A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled
35 on the drawings.

- 36 1. Air quantity shall be factory set.
- 37 2. Thermostat signal shall reset the flow control device to reduce primary air quantity to
38 match load requirements.
- 39 3. Control shall be pressure independent.
- 40 4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to
41 a center averaging chamber to ensure the following performance:
42 a. Controller fidelity shall be +/-5% of set volume with a flex inlet
43 configuration and inlet static variation of 0.5" WG to 6.0" WG.
- 44 5. Provide flow measuring taps and a flow chart with each unit for field balancing air
45 flow.

46
47 B. HOT WATER HEATING COILS

- 48 1. Provide hot water heating coils sized as scheduled.
49 a. The hot water heating coil is specified to be provided and mounted under
50 the work of this Section.
- 51 b. Coil access door upstream of coil.
- 52 c. Install coil with supply inlet at bottom and on leaving airside of coil.
- 53 d. Maximum static pressure drop of water through heating coil shall not
54 exceed 10' w.g.
- 55 e. Maximum static pressure drop of air through heating coil shall not exceed
56 0.25" esp.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.
- B. Install each unit in accordance with the manufacturer's printed installation instructions.
- C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
 - 1. Provide sub-structure where required.
 - 2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
 - 3. Install units so that they are level and plumb.
- D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.
- E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.
- F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.
- G. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- H. All installation shall be in accordance with manufacturer's published recommendations.
- I. Provide clearance for inspection, repair, replacement and service. Ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located a minimum of 30 inches from all obstructions (walls, pipe, etc.).
- J. Provide ceiling access doors or locate units above easily removable ceiling components.
- K. Support units individually from structure. Do not support for adjacent ductwork. Terminal units shall be supported using unit's hanger brackets and threaded rods.

3.2 MISCELLANEOUS CONTROLS

- A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
 - 1. Automatic temperature control card (DDC).
 - 2. Damper actuator.
- B. The following equipment items are to be furnished and installed by the Fan Powered Terminal Unit manufacturer:
 - 1. Damper.
 - 2. Multi-point flow sensor.

3. Controller enclosure.
4. Power transformer.

- C. Coordinate the output voltage required by the Building Management and Control System.
- D. Coordinate location of controller enclosure.

3.3 ACOUSTICAL PERFORMANCE TEST

- A. Test each size for each type of variable air volume unit furnished on the project.
- B. Test for radiated noise and discharge noise in all operational modes from minimum to maximum primary air settings; at inlet air pressures of 1 and 2 inches water column, and at primary air settings of 20, 40, 60 and 100 percent.
- C. Testing shall be done by an independent testing laboratory. Sound values submitted shall be certified by the laboratory doing the testing. Testing laboratory must be approved by Engineer. Final testing and approval must be witnessed by Engineer.
- D. Testing procedures shall be in accordance with ASHRAE Standard 130-96 and rated in accordance with ARI 880.
- E. Test the unit complete with damper, coils and controls. The unit shall be operational and represent a final version of the units to be installed on the project.
- F. If the units do not meet sound criteria, modify the units and retest at no additional cost to the Owner until the sound criteria is in accordance with Contract Documents. The variable air volume unit manufacturer shall be held liable for the costs associated with construction delays resulting from failed test, not to exceed the purchase order cost.
- G. Sound Levels: Maximum sound power levels resulting from any box shall not exceed the following:

OCTAVE BAND CENTER FREQUENCY, Hz.						
	125	250	500	1000	2000	4000
Radiated SPL db	52	45	40	36	34	33
Discharge SPL db	44	37	31	27	24	22

1. Sound power levels are referenced to 10-12 watts.
2. Box inlet static pressure = 1-1/2"
3. No discounting for roof effect, ceiling attenuation, lined duct, division of flow and other similar effects.

- H. All terminal boxes shall be equipped with a sheetmetal elbow with liner connected to plenum air inlet.

3.4 SPARE PARTS

- A. Provide one spare motor for each size box.

END OF SECTION

SECTION 23 37 13

AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

- A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.
- B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

- A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.2 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger.
- C. Nailor Industries.
- D. Price
- E. Metal-Aire

2.3 ACCESSORIES

- A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct.

1
2 Select extractors similar to Titus Model AG25, tight-closing in the minimum position.
3 Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from
4 the grille opening. Where adjustment is not accessible at the grille opening, provide a
5 square control rod equipped with a locking quadrant.
6

7 B. Mounting Frames. Provide each grille or register not equipped with a removable core
8 with a companion, all-purpose mounting frame constructed like grille frame to facilitate
9 installation and removal of the grille or register without marring adjacent mounting
10 surfaces.

- 11 1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
- 12 2. Provide a frame that neatly fits the grille. Mounting frames will not be required
13 for grilles or registers mounted directly on exposed ductwork.
14

15 PART 3 - EXECUTION

16 3.1 INSPECTION

17 A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply
18 assemblies, return-air blank-off strips and flexible duct have been approved. Remove and
19 reinstall any part of the installation found incorrect.
20
21
22

23 3.2 INSTALLATION

24 A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with
25 sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed
26 hinge assembly to an outer frame compatible with the type of ceiling on which the
27 diffuser is installed.
28
29

30 END OF SECTION

SECTION 23 41 00

AIR FILTRATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air filters and air filter gauges.

1.2 RELATED WORK

- A. Division 23 Mechanical.

1.3 SUBMITTALS

- A. Submit manufacturer's product data sheets and capacity information as specified.
- B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

- A. The filter cells:
1. Pleated media.
 2. Disposable type.
 3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
 4. 16 pleats per linear foot of filter.
 5. 2" thick.
 6. MERV 8
- B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
1. Seal the media pack in a chipboard frame.
- C. Rated average dust spot efficiency of not less than 36%.
1. Average synthetic arrestance in excess of 93% when tested in accordance with the ASHRAE 52-68 test standard.
- D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.
- E. Initial resistance to air flow:
1. 300 fpm - 0.12" WG.
 2. 500 fpm - 0.28" WG.
- F. UL listed with Class II rating.
- G. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.

PART 3 - EXECUTION

3.1 INSTALLATION

AIR FILTRATION

23 41 00-1

1
2
3
4

- A. Install the filters and filter gauges in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 23 55 33
GAS FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install gas fired unit heaters complete with combustion chamber, heating element, draft diverter, burner, control manifold, casing and air impeller.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
1. Electrical Provisions of Mechanical Work
2. Ductwork

1.3 REFERENCES

- A. Units shall be approved by the American Gas Association.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Modine
B. Reznor
C. Sterling
D. Trane

2.2 COMPONENTS

- A. Casing: Construct casing of sheetmetal with a structural frame. Apply enamel or lacquer finish to manufacturer's standard.
B. Heat Exchanger: Direct-fired primary heat exchanger tubes constructed of stainless steel.
C. Louvers: Provide adjustable vertical and horizontal louvers for air discharge.

2.3 CONTROLS

- A. Furnish automatic controls, factory mounted and prewired to the junction box, except for the room thermostat.
B. Furnish an electric main burner gas valve.
C. Provide a pilot safety control valve arranged for 100% safety shutoff. Provide unit with automatic electric pilot ignition.
D. Furnish high limit temperature control, a space thermostat, a gas pressure regulator, and manual gas shutoff valve.

2.4 FAN

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

- A. Provide a propeller blade fan, connected directly to the drive motor. Construct the fan of aluminum or other corrosion-resistant material. Have fans statically and dynamically balanced, and equipped with a substantial fan guard.

2.5 MOTOR

- A. Provide a totally enclosed, 120 volt, single phase, 60 cycle motor sized to operate the fan at the required capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Furnish units with suitable connections for mounting as shown or as otherwise approved.

END OF SECTION

SECTION 23 74 15

PACKAGE ROOFTOP VARIABLE VOLUME AIR CONDITIONERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install a package, variable volume electric air conditioner for ground mounted application.

1.2 RELATED WORK

- A. Division 23 Mechanical.
 - 1. Ductwork.
 - 2. Air Balance.
 - 3. Electrical provisions of mechanical work.
 - 4. Air filtration.
 - 5. Variable Volume Terminal Units.

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings.

1.4 QUALITY ASSURANCE

- A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- C. System Seasonal Energy Efficiency Ratio/Energy Efficiency Ratio (SEER/EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- D. Unit shall be safety certified by ETL and be ETL US listed.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Literature shall be provided that indicates dimensions, operating and shipping weights, certified capacities, ratings, factory supplied accessories, electrical characteristics, and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.
- B. Shop Drawings:
 - 1. Unit drawings shall be provided that indicates assembly, unit dimensions, construction details, service and air flow clearances, and connection details. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.
- C. Submit coordination drawings as specified. Give consideration to adjacent structures as they affect air flow patterns.
- D. Submit sequence of operation in narrative form.

PACKAGE ROOFTOP VARIABLE VOLUME AIR CONDITIONERS

- 1 E. Mark-up a copy of the specifications indicating in the margin of each paragraph the
2 following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.
3
- 4 1.6 DELIVERY, STORAGE, AND HANDLING
5
- 6 A. Unit shall be shipped with doors bolted shut to prevent damage during transport and
7 thereafter while in storage awaiting installation.
8
- 9 B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and
10 unloading the unit at its final location.
11
- 12 C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance
13 with the Installation, Operation and Maintenance manual.
14
- 15 1.7 WARRANTY
16
- 17 A. Manufacturer shall provide a parts and labor warranty for a period of 1 year from the date of
18 substantial completion. Warranty excludes parts associated with routine maintenance and
19 refrigerant.
20
- 21 B. Compressor shall be provided with a 5 year non-prorated parts and labor warranty including
22 recharging refrigerant system.
23
- 24 PART 2 - PRODUCTS
25
- 26 2.1 ACCEPTABLE MANUFACTURERS
27
- 28 A. Carrier (Houston Direct Sales Office)
29
- 30 B. Trane
31
- 32 2.2 COMPRESSOR
33
- 34 A. Compressors shall be scroll type with thermal overload protection, and independently
35 circuited. Unit shall include variable speed scroll compressor on all circuits, which shall be
36 capable of modulation from 10-100% of its capacity.
37
- 38 B. Each compressor shall include a crankcase heater.
39
- 40 C. Compressors shall be mounted in an isolated service compartment which can be accessed
41 without affecting unit operation. Lockable hinged access doors shall provide access to the
42 compressors.
43
- 44 D. Compressors shall be isolated from the base pan with the compressor manufacturer's
45 recommended rubber vibration isolators, to reduce any transmission of noise from the
46 compressors into the building area.
47
- 48 E. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual
49 reset high pressure refrigerant safety controls, Schrader type service fittings on both the high
50 pressure and low pressure sides, and service valves for liquid and suction connections. Liquid
51 line filter driers shall be factory provided. Finished field installed refrigerant circuits shall
52 include the low side cooling components, refrigerant, thermal expansion valve, liquid line,
53 insulated hot gas bypass line, insulated hot gas line and insulated suction line.
54
- 55 F. Unit shall include a factory holding charge of a refrigerant not scheduled for phase out

- 1 during life of the unit.
- 2
- 3 G Each compressor shall be equipped with a 5 minute off, delay timer to prevent compressor
- 4 short cycling.
- 5
- 6 H. The unit be provided with discharge temperature controls and shall be capable of stable
- 7 cooling operation to a minimum a unit discharge temperature as scheduled down to 55°F
- 8 outdoor temperature.
- 9
- 10 2.3 EVAPORATOR AND CONDENSER COILS
- 11
- 12 A. Provide the evaporator coil constructed of copper tubes with mechanically bonded aluminum
- 13 fins and stainless-steel end casings.
- 14
- 15 B. Provide the condenser coil constructed of an aluminum microchannel design and shall have a
- 16 series of flat tubes containing multiple, parallel flow microchannel layered between the
- 17 refrigerant manifolds.
- 18
- 19 C. Provide an evaporator coil with interlaced circuitry.
- 20
- 21 D. Provide factory installed louvered hail / vandalism guards for condenser coils.
- 22
- 23 E. Provide coils with stainless steel casings, end plates, tube supports and top and bottom plates.
- 24
- 25 F. Provide condenser coil coated with corrosion resistant epoxy utilizing a dip and bake process.
- 26 Coating shall be flexible and uniformly bonded to all condenser coil surfaces.
- 27
- 28 G. A primary drain pan over flow safety shall shut off the unit and issue a warning before over
- 29 flow occurs.
- 30
- 31 2.4 EVAPORATOR FANS
- 32
- 33 A. Unit shall be equipped with a direct drive variable speed direct drive, single inlet airfoil
- 34 centrifugal fan. The fan wheel shall be Class 2 construction with fan blades that are
- 35 continuously welded to the hub and end rim.
- 36
- 37 B. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
- 38
- 39 C. Motor shall contain premium efficiency ODP with self-aligning ball bearings rated for
- 40 200,000 hours service with external lubrication ports grouped near the motor access side of
- 41 the unit. Provide motor HP as indicated on the drawings.
- 42
- 43 D. The unit shall be provided with a duct mounted static pressure sensor for field installation.
- 44 Static pressure sensor shall provide feedback to unit to modulate the unit supply fan.
- 45
- 46 2.5 CASING, FILTERS AND DUCT CONNECTION
- 47
- 48 A. Provide a cabinet constructed of galvanized or zinc-coated steel, primed and coated with
- 49 baked enamel and suitable for outdoor installation.
- 50
- 51 B. Unit shall be equipped with duct connections on the bottom of each unit, as indicated on
- 52 drawings.
- 53
- 54 C. Provide motorized outside air damper for shut off and airflow measuring station to maintain
- 55 scheduled outside air amounts.

- 1
2 D. Unit shall be equipped with a filter frame to match the filter requirements specified in
3 Section 23 41 00.
4
5 E. Provide with stainless steel condensate drain pan with positive slope in all directions to
6 outlet.
7 1. Externally line the condensate drain pan with 1-1/2" waterproof insulation.
8 2. Provide a hinged access door with quick release handle adjacent to condensate drain
9 pan for inspection. Install access door on drain connection side of unit.
10
11 F. Panel construction shall be double-wall construction for all panels. All floor panels shall
12 have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation
13 during service and maintenance. Insulation shall be a minimum of 2" thick with an R-value
14 of 13.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation
15 edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.
16
17 G. Furnish through-the-curb electrical service connection.
18
19 2.6 CONTROLS
20
21 A. Provide safety and operating controls factory wired and mounted in a separate enclosure.
22 Include thermostatic expansion valve, high and low pressure switches and compressor motor
23 overload devices. Furnish a time delay device to prevent short cycling. Employ a control
24 transformer, a pressure relief device and suction and discharge valves with service
25 connections.
26
27 B. Provide with BACNET control interface as required by BMCS system. BMCS shall have the
28 ability to control ON/OFF, and leaving air temperature set point.
29
30 C. Unit shall utilize a variable capacity compressor system and a variable speed supply fan
31 system to modulate cooling and air flow.
32 1. Cooling shall be controlled to maintain a discharge air setpoint. This setpoint shall
33 be capable of being modified through the BMCS.
34 2. The unit supply fan shall modulate based on duct static pressure. Unit shall be
35 provided with a manufacturer supplied duct static pressure sensor.
36
37 2.7 ROOF CURB
38
39 A. Install a hot dipped galvanized welded steel insulated (R-8 Minimum) welded ground
40 mounted curb with supply air discharge as specified on Drawings. Roof curb shall be hot
41 dipped galvanized assembled after fabrication is complete.
42 1. Curb shall be fully gasketed between the curb top and unit bottom with the curb
43 providing full perimeter support, cross structure support and air seal for the unit.
44 Curb gasket shall be furnished within the control compartment of the rooftop unit to
45 be mounted on the curb immediately before mounting of the rooftop unit.
46 2. Level curb according to manufacturer's recommendations.
47 3. Curb height shall be a minimum of 14".
48
49 2.8 OUTDOOR FANS
50
51 A. Unit shall be equipped with a direct drive propeller type fan with permanently lubricated
52 motor. Fan shall discharge upward.
53
54 B. The unit controller shall proportionally control the speed of the condenser fan motors to
55 maintain the head pressure of the refrigerant circuit from ambient condition of 0~120°F.
56

1 C. The motor shall include thermal overload protection and protect the motor in the case of
2 excessive motor temperatures. The motor shall have phase failure protection and prevent the
3 motor from operation in the event of a loss of phase.
4

5 D. The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic
6 profile for low tip speed. Fan blade shall be of a composite material
7

8 2.9 CONVENIENCE OUTLET
9

10 A. Unit shall be equipped with a factory installed and field wired 120V, 20 AMP GFI outlet in
11 unit cabinet.
12

13 2.10 SERVICE DISCONNECT SWITCH
14

15 A. Unit shall be equipped with a factory installed field wired, non-fused disconnect switch with
16 external locking handle.
17

18 2.11 TEMPERATURE CONTROL
19

20 A. Unit shall be controlled by maintaining a constant leaving air temperature as scheduled on
21 the drawings. Open outside air damper prior to starting fan.
22

23 2.12 MOTORIZED OUTSIDE AIR DAMPER
24

25 A. Low leakage 14-gauge galvanized steel
26 1. Airfoil blades
27 2. Ruskin CD60
28

29 PART 3 - EXECUTION
30

31 3.1 INSTALLATION
32

33 A. Install according to manufacturer's recommendations and as shown on drawings.
34

35 B. Installing contractor shall install field installed components, in accordance with Installation,
36 Operation and Maintenance manual instructions.
37

38 3.2 START UP
39

40 A. Provide the services of a factory trained service technician employed full time by the unit
41 manufacturer to start-up the system, or manufacturer's factory authorized representative
42 under the supervision of the factory trained service technician. Upon completion of the
43 installation, the system shall be started and commissioned by the manufacturer's factory
44 authorized representative who will verify a complete fully functional system. The factory
45 authorized representative will verify that accessories are installed and performing the
46 specified functions. (Contractor startup is unacceptable.)
47

48 B. The written startup report shall be provided to the owner and engineer upon completion.
49
50

END OF SECTION

SECTION 23 81 18

SINGLE PACKAGE ROOFTOP AIR CONDITIONERS (100% Outside Air)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install a single-package, single-zone, electric 100% outside air conditioner unit with gas-fired heat for ground mounted applications.

1.2 RELATED WORK

- A. Division 23 Mechanical:
 - 1. Ductwork
 - 2. Air Balance
 - 3. Electrical provisions for mechanical work
 - 4. Air Filtration
 - 5. Vibration Isolation

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings.

1.4 QUALITY ASSURANCE

- A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- C. System Seasonal Energy Efficiency Ratio/Energy Efficiency Ratio (SEER/EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- D. Unit shall be safety certified by ETL and be ETL US listed.

1.5 SUBMITTALS

- A. Manufacturer's certified capacity data
- B. Submit manufacturer's installation, start-up and service instructions.
- C. Submit recommended clearance dimensions for air flow and service.
- D. Submit coordination drawings as specified. Consideration shall be given to adjacent structures and their effect on air flow patterns.
- E. Submit internal wiring diagram of Control Center
- F. Submit sequence of operation in narrative form.
- G. Mark-up a copy of the specifications indicating in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1 1.6 DELIVERY, STORAGE, AND HANDLING

- 2
- 3 A. Unit shall be shipped with doors bolted shut to prevent damage during transport and
- 4 thereafter while in storage awaiting installation.
- 5
- 6 B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving,
- 7 and unloading the unit at its final location.
- 8
- 9 C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance
- 10 with the Installation, Operation and Maintenance manual.
- 11

12 1.7 WARRANTY

- 13
- 14 A. Manufacturer shall provide a parts and labor warranty for a period of 2 year from the date of
- 15 delivery. Warranty excludes parts associated with routine maintenance and refrigerant.
- 16
- 17 B. Compressor shall be provided with a 5 year non-prorated parts and labor warranty including
- 18 recharging refrigerant system.
- 19
- 20 C. Stainless steel heat exchanger shall be provided with a minimum of a 10 year non-prorated
- 21 parts and labor warranty.
- 22

23 PART 2 - PRODUCTS

24

25 2.1 ACCEPTABLE MANUFACTURERS

- 26
- 27 A. Carrier (Houston Direct Sales Office)
- 28
- 29 B. Trane
- 30

31 2.2 COMPRESSOR

- 32
- 33 A. Compressors shall be a fully modulating digital scroll or variable speed scroll type with
- 34 thermal overload protection, independently circuited and shall be capable of modulation
- 35 from 10-100% of its capacity and allow for airflow turn down to 30% of full flow.
- 36
- 37 B. Each compressor shall include a crankcase heater.
- 38
- 39 C. Compressors shall be mounted in an isolated service compartment which can be accessed
- 40 without affecting unit operation. Lockable hinged access doors shall provide access to the
- 41 compressors.
- 42
- 43 D. Compressors shall be isolated from the base pan with the compressor manufacturer's
- 44 recommended rubber vibration isolators, to reduce any transmission of noise from the
- 45 compressors into the building area.
- 46
- 47 E. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual
- 48 reset high pressure refrigerant safety controls, Schrader type service fittings on both the high
- 49 pressure and low pressure sides, and service valves for liquid and suction connections.
- 50 Liquid line filter driers shall be factory provided. Finished field installed refrigerant circuits
- 51 shall include the low side cooling components, refrigerant, thermal expansion valve, liquid
- 52 line, insulated hot gas bypass line, insulated hot gas and suction lines.
- 53
- 54 F. Unit shall include a factory holding charge of R-410a refrigerant.
- 55

- 1 G Each compressor shall be equipped with a 5 minute off, delay timer to prevent compressor
2 short cycling.
3
4 H. The unit shall be capable of stable cooling operation to a minimum of 35°F outdoor
5 temperature.
6
7 I. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves,
8 electronic controller, supply air temperature sensor and a dehumidification control signal
9 terminal.
10
11 J. Provide each compressor with a Removable Sound Cover that is constructed of a Silicone-
12 fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11
13 lbs./ft.3 density), and a Silicone-fiberglass cloth inner jacket. The covers shall be connected
14 together by means of a cloth straps with “D” rings and Velcro fasteners. The inner and
15 outer jackets shall protect against UV rays, oil and water. Finished Surface Mass – 3 lbs.
16 per sq. ft., to cover compressors and extended components for the specified equipment.
17 Manufactured by BRD Noise and Vibration Control or engineer approved equal.
18

19 2.3 EVAPORATOR, CONDENSER AND REHEAT COILS
20

- 21 A. Provide the evaporator and hot gas reheat coil constructed of copper tubes with
22 mechanically bonded aluminum fins and stainless-steel end casings.
23
24 B. Provide the condenser coil constructed of an aluminum microchannel design and shall have
25 a series of flat tubes containing multiple, parallel flow microchannel layered between the
26 refrigerant manifolds.
27
28 C. Provide an evaporator coil with interlaced circuitry. Provide a minimum of 12” clearance
29 downstream of the evaporator and hot gas reheat coils.
30
31 D. Provide factory installed louvered hail / vandalism guards for condenser coils.
32
33 E. Provide coils with stainless steel casings, end plates, tube supports and top and bottom
34 plates.
35
36 F. Provide the condenser, evaporator and reheat coils coated with corrosion resistant epoxy
37 utilizing a dip and bake. Coating shall be flexible and uniformly bonded to all condenser
38 coil surfaces and shall meet a minimum of 6,000 hours corrosion resistance per ASTM
39 B117.
40
41 G. Provide a hinged access doors with quick release handle adjacent to each coil for inspection
42 and maintenance.
43

44 2.4 EVAPORATOR FANS
45

- 46 A. Unit shall be equipped with a direct drive, backward curved airfoil blade, centrifugal
47 evaporator fan.
48
49 B. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
50
51 C. Motor shall contain premium efficiency TEFCP with self-aligning ball bearings rated for
52 200,000 hours service with external lubrication ports grouped near the motor access side of
53 the unit. Provide motor HP as indicated on the drawings.
54

55 2.5 GAS HEATING SECTION
56

- 1 A. Unit shall be equipped with stainless steel burners and heat exchangers.
- 2
- 3 B. Gas furnace shall be equipped with modulating gas valves, adjustable speed combustion
- 4 blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion
- 5 blowers and gas valves shall be capable of modulation. Electronic controller includes a
- 6 factory wired, field installed supply air temperature sensor. Sensor shall be field installed in
- 7 the supply air ductwork. Supply air temperature set point shall be adjustable on the
- 8 electronic controller within the controls compartment.
- 9
- 10 C. Gas Controls.
- 11 1. Automatic gas valve and pressure regulator.
- 12 2. A manual shutoff valve.
- 13 3. Pilot valve.
- 14 4. Two flame rollout limit switches.
- 15 5. An adjustable fan control.
- 16 6. Fixed high limit controls
- 17
- 18 D. Unit shall be equipped with an electric spark pilot ignition system.
- 19 1. Electronic flame detection.
- 20 2. 100% safety shutoff.
- 21
- 22 E. Combustion air shall be induced by a positive pressure power venting fan.
- 23 1. Pre-purge of combustion chamber.
- 24
- 25 2.6 CASING, FILTERS AND DUCT CONNECTION
- 26
- 27 A. Provide a cabinet constructed of galvanized or zinc-coated steel, primed and coated with
- 28 baked enamel and suitable for outdoor installation. Exterior paint finish shall be capable of
- 29 withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt
- 30 spray and fog atmosphere in accordance with ASTM B117-95 test procedure.
- 31
- 32 B. Unit shall be equipped with duct connections on the bottom of each unit to coordinate with a
- 33 ground mounted discharge curb as indicated on drawings.
- 34
- 35 C. Provide two-position, motorized spring return outdoor air damper constructed of extruded
- 36 aluminum air foil blades with rubber edge and end seals. Damper assembly shall be Class 2
- 37 AMCA Certified.
- 38
- 39 D. Unit shall be equipped with an outside air hood with a minimum of 1" thick aluminum mesh
- 40 pre-filters.
- 41
- 42 E. Unit shall be equipped with a filter frame to match the filter requirements specified in
- 43 Section 23 41 00.
- 44
- 45 F. Provide with stainless steel condensate drain pan with positive slope in all directions to
- 46 outlet.
- 47 1. Externally line the condensate drain pan with 1-1/2" waterproof insulation.
- 48 2. Provide a hinged access door with quick release handle adjacent to condensate
- 49 drain pan for inspection. Install access door on drain connection side of unit.
- 50 3. Drain pan shall be insulated with a minimum 2" thick foam insulation.
- 51
- 52 G. Double wall casing construction
- 53 1. Construct roof, wall, and floor with minimum 2-inch-thick, 2 lb. density, R-13
- 54 injected polyurethane foam insulated, double wall panels with thermal break for
- 55 superior energy efficiency and casing longevity.
- 56 2. Unit shall be designed to reduce air leakage and infiltration through the cabinet.

Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.

3. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

4. Access to filters, dampers, cooling coils, reheat coil, heaters, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors. Units without full hinged access doors in the cooling coil section are not acceptable.

2.7 CONTROLS

A. Provide safety and operating controls factory wired and mounted in an integral controls and electrical enclosure. Include thermostatic expansion valve, high and low-pressure switches and compressor motor overload devices. Furnish a time delay device to prevent short cycling. Employ a control transformer, a pressure relief device and suction and discharge valves with service connections. Include a high condensate level switch that shuts down the unit when a high-water level is detected in the drain pan.

B. Unit shall be provided with a fully functional DDC control system with BACnet MS/TP integration. BCMS system shall have the ability to remotely start/stop the unit, adjust supply air temperature heating and cooling setpoints, and adjust targeted supply air dew point setpoint during dehumidification mode.

1. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
2. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
3. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
4. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a BACnet network.

2.8 ROOF CURB

A. Install a hot dipped galvanized welded steel insulated (R-8 Minimum) welded ground mounted curb with supply air discharge as specified on Drawings. Roof curb shall be hot dipped galvanized assembled after fabrication is complete.

1. Curb shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit.

- 1 Curb gasket shall be furnished within the control compartment of the rooftop unit
2 to be mounted on the curb immediately before mounting of the rooftop unit.
3 2. Level curb according to manufacturer's recommendations.
4 3. Curb height shall be a minimum of 14".
5
6 2.9 OUTDOOR FANS
7
8 A. Unit shall be equipped with a direct drive propeller type fan with permanently lubricated
9 TEFC motor. Fan shall discharge upward.
10
11 B. Condenser fans shall be VFD driven variable speed for active condenser head pressure
12 control.
13
14 2.10 CONVENIENCE OUTLET
15
16 A. Unit shall be equipped with a factory installed and field wired 120V, 20 AMP GFI outlet in
17 unit cabinet.
18
19 2.11 SERVICE DISCONNECT SWITCH
20
21 A. Unit shall be equipped with a factory installed field wired, circuit breaker with external
22 locking handle.
23
24 2.12 TEMPERATURE AND FAN CONTROL
25
26 A. Unit shall be controlled by maintaining a constant supply air temperature leaving the
27 evaporator coil as scheduled on the drawings. When the outside air temperature drops below
28 the scheduled leaving air temperature, the unit shall enter heating mode and the natural gas
29 heater shall modulate to maintain the heating mode supply air temperature setpoint. When
30 the outside air temperature is above the scheduled supply air temperature, the unit shall
31 enter dehumidification priority mode, the compressor capacity shall be modulating to
32 maintain the active evaporator coil temperature setpoint and the modulating hot gas reheat
33 valve shall be controlled to maintain the cooling mode supply air temperature setpoint. The
34 evaporator coil temperature must be controlled by the use of suction pressure transducers
35 installed on each refrigeration circuit. The use of an evaporator coil temperature sensor is
36 not allowed. The unit shall be able to independently control the supply air dry bulb and wet
37 bulb temperatures under all OA loads during cooling mode. Open outside air damper prior
38 to starting fan and close damper during unoccupied mode.
39
40 B. Unit shall be provided in a variable air volume configuration. Provide unit with a duct
41 mounted pressure sensor to control the fan speed and a duct mounted discharge air
42 temperature sensor to control unit discharge air temperature.
43
44 2.13 PHASE MONITORING PROTECTION
45
46 A. Provide unit with phase monitoring protection to protect motors and compressors against
47 issue associated with phase loss, phase imbalance and phase reversal.
48
49 2.14 RETURN AIR SECTION
50
51 A. Unit shall be provided with a return air damper and opening as indicated on the drawings.
52
53 B. The return air mode shall operate as scheduled through BMCS and as required to maintain
54 space humidity levels.
55
56 2.15 MOTORIZED OUTSIDE AIR DAMPER AND RETURN AIR DAMPER

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

- A. Low leakage 14-gauge galvanized steel
 - 1. Airfoil blades
 - 2. Ruskin CD60

PART 3 - EXECUTION

3.1 START UP

- A. Provide the services of a factory trained service technician employed full time by the unit manufacturer to start-up the system, or manufacturer's factory authorized representative under the supervision of the factory trained service technician. Upon completion of the installation, the system shall be started and commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system. The factory authorized representative will verify that accessories are installed and performing the specified functions. (Contractor startup is unacceptable.)
- B. The written startup report shall be provided to the owner and engineer upon completion.

END OF SECTION

SECTION 23 81 19

SINGLE PACKAGE ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install a single-package, single-zone variable air volume unit, electric air conditioner with gas-fired heat for ground mounted application.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
 - 1. Ductwork
 - 2. Air Balance
 - 3. Electrical provisions for mechanical work
 - 4. Air filtration

1.3 PERFORMANCE

- A. As scheduled on drawings, with head pressure control to enable unit start and operate down to 20 degrees F ambient.

1.4 QUALITY ASSURANCE

- A. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- B. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- C. System Seasonal Energy Efficiency Ratio/Energy Efficiency Ratio (SEER/EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- D. Unit shall be safety certified by ETL and be ETL US listed.

1.5 SUBMITTALS

- A. Manufacturer's certified capacity data
- B. Submit manufacturer's installation, start-up and service instructions.
- C. Submit recommended clearance dimensions for air flow and service.
- D. Submit coordination drawings as specified. Consideration shall be given to adjacent structures and their effect on air flow patterns.
- E. Submit internal wiring diagram of Control Center
- F. Submit sequence of operation in narrative form.
- G. Mark-up a copy of the specifications indicating in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Unit shall be shipped with doors bolted shut to prevent damage during transport and thereafter while in storage awaiting installation.
- B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

1.7 WARRANTY

- A. Manufacturer shall provide a parts and labor warranty for a period of 2 year from the date of delivery. Warranty excludes parts associated with routine maintenance and refrigerant.
- B. Compressor shall be provided with a 5 year non-prorated parts and labor warranty including recharging refrigerant system.
- C. Stainless steel heat exchanger shall be provided with a minimum of a 10 year non-prorated parts and labor warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier (Houston Direct Sales Office)
- B. Trane

2.2 COMPRESSOR

- A. Provide a thermally protected, serviceable semi-hermetic compressor or hermetic compressor with service valves, vibration isolation, crankcase heaters, sight glass and filter dryer.
- B. The permanent magnet type compressor shall be capable of speed modulation from 15Hz to a maximum of 60 Hz. The minimum unit capacity shall be 25% of full load or less. Each variable speed compressor shall be matched with a specially designed, refrigerant-cooled, variable frequency drive which modulates the speed of the compressor motor and provides several compressor protection functions. Control of the variable speed compressor and inverter control, as well as tandem direct-drive, scroll type compressors, shall be integrated with the unit controller to ensure optimal equipment reliability and efficiency.
- C. Provide refrigerant not scheduled for phase out during the life of the unit.

2.3 EVAPORATOR AND CONDENSER COILS

- A. Provide the evaporator coil constructed of copper tubes with mechanically bonded aluminum fins and stainless-steel end casings.
- B. Provide the condenser coil constructed of an aluminum microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannel layered between the refrigerant manifolds.

- 1 C. Provide hail guards for condenser coils.
- 2
- 3 D. Provide condenser coils coated with corrosion resistant epoxy utilizing a dip and bake.
- 4 Coating shall be flexible and uniformly bonded to all condenser coil surfaces.
- 5
- 6 2.4 EVAPORATOR FANS
- 7
- 8 A. Provide a variable speed direct- driven, forward-curved, centrifugal evaporator fan. Motor
- 9 shall contain permanently lubricated bearings. Provide motor HP as indicated on the
- 10 drawings.
- 11
- 12 2.5 GAS HEATING SECTION
- 13
- 14 A. Unit shall be equipped with corrosion resistant burners and heat exchangers.
- 15
- 16 B. Gas Controls.
- 17 1. Automatic gas valve and pressure regulator.
- 18 2. A manual shutoff valve.
- 19 3. Pilot valve.
- 20 4. Two flame rollout limit switches.
- 21 5. An adjustable fan control.
- 22 6. Fixed high limit controls
- 23
- 24 C. Unit shall be equipped with an electric spark pilot ignition system.
- 25 1. Electronic flame detection.
- 26 2. 100% safety shutoff.
- 27
- 28 D. Combustion air shall be induced by a positive pressure power venting fan.
- 29 1. Prepurge of combustion chamber.
- 30
- 31 E. Furnish through-the-bottom electrical service connection.
- 32
- 33 2.6 CASING FILTERS AND DUCT CONNECTION
- 34
- 35 A. Provide a cabinet constructed of galvanized or zinc-coated steel, primed and coated with
- 36 baked enamel and suitable for outdoor installation.
- 37
- 38 B. Provide duct connections on the bottom of each unit, as indicated on drawings.
- 39
- 40 C. Provide manually operated outdoor air dampers.
- 41
- 42 D. Furnish 2" thick filters as specified.
- 43
- 44 E. Furnish through-the-bottom electrical service connection.
- 45
- 46 2.7 ROOF CURB
- 47
- 48 A. Install a hot dipped galvanized welded steel insulated (R-8 Minimum) welded ground
- 49 mounted curb with supply air discharge as specified on Drawings. Roof curb shall be hot
- 50 dipped galvanized assembled after fabrication is complete.
- 51 1. Curb shall to be fully gasketed between the curb top and unit bottom with the curb
- 52 providing full perimeter support, cross structure support and air seal for the unit.
- 53 Curb gasket shall be furnished within the control compartment of the rooftop unit
- 54 to be mounted on the curb immediately before mounting of the rooftop unit.
- 55 2. Level curb according to manufacturer's recommendations.
- 56 3. Curb height shall be a minimum of 14".

2.8 OUTDOOR FANS

- A. Provide propeller type with direct-driven permanently lubricated motor. Fan shall discharge upward.

2.9 THERMOSTAT ASSEMBLY

- A. Provide staged heating and cooling as required, automatic changeover and fan control.

2.10 HEAD PRESSURE CONTROL

- A. Provide solid state outdoor air fan speed control to permit unit to operate down to -20°F.

2.11 SHORT CYCLE CIRCUIT

- A. Provide circuit to prevent compressor from short cycling as a result of a rapid change in thermostat setting. Circuit also prevents compressor restart at least 5 minutes after shutdown.

2.12 CONVENIENCE OUTLET

- A. Provide 115V outlet in unit cabinet.

2.13 MOTORIZED OUTSIDE AIR DAMPER

- A. Low Leakage 14-gauge galvanized steel
1. Airfoil Blades
2. Ruskin CD60

2.14 DEHUMIDIFICATION

- A. Unit shall be factory programmed with a dehumidification cycle.

2.15 HUMIDISTAT

- A. Wall Mounted
B. Shall control activation of dehumidification coil
C. Humidity levels between 20% to 80% relative humidity.

2.16 PHASE MONITORING PROTECTION

- A. Provide unit with phase monitoring protection to protect motors and compressors against issue associated with phase loss, phase imbalance and phase reversal.

2.17 CONTROLS

- A. Unit shall be provided with a fully functional DDC control system with BACnet MS/TP integration. BCMS system shall have the ability to remotely start/stop the unit, adjust supply air temperature heating and cooling setpoints.

2.18 ULTRA-LOW LEAK ECONOMIZERS WITH ENTHALPHY CONTROL

- A. Unit shall be provide with factory installed ultra-low leak economizer.

- 1 B. Ultra-Low Leak economizer dampers shall meet and comply with California's Title 24
2 section 140.4 prescriptive requirements for leakage, reliability testing, etc., and ASHRAE
3 90.1-2013 requirements for damper leakage.
4
5 C. Provide economizer with integrated, gear driven opposed blade design type capable of
6 simultaneous economizer and compressor operation.
7
8 D. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades
9 on intake or return shall not be acceptable.
10
11 E. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the
12 return air for positive air stream control.
13
14 F. Shall be capable of introducing up to 100% outdoor air.
15
16 G. Economizer's barometric relief dampers shall be sized to allow up to 100% relief.
17 1. Economizer Controls:
18 a. Meets California's Title 24 section 120.2 mandatory requirements for
19 economizer Fault Detection and Diagnosis (FDD).
20 b. Economizer controller shall be Honeywell W7220 or equal that provides:
21 i. 2-line LCD interface screen for setup, configuration and
22 troubleshooting.
23 ii. On-board FDD detects and alerts when economizer is not
24 operating properly.
25 iii. Sensor failure loss of communication identification.
26 iv. Automatic sensor detection.
27 v. Capabilities for use with multi-speed indoor fan units.
28 c. Compressor lockout temperature on W7220 is adjustable from -45°F (-
29 43°C) to 80°F (27°C), set at a factory default of 32°F (0°C).
30 d. Shall be designed to spring return close outside air damper during loss of
31 power.
32 e. Actuator shall be direct coupled to economizer gear. No linkage arms or
33 control rods shall be acceptable.
34 f. Utilizes digital dry bulb or enthalpy outside air sensors. Factory-installed
35 economizers available with dry bulb or enthalpy. Dry bulb sensors
36 installed on all field-installed economizer accessories.
37

38 2.19 RETURN AIR ENTHALPHY SENSOR
39

- 40 A. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy
41 sensor to provide differential enthalpy control.
42

43 2.20 OUTDOOR AIR ENTHALPHY SENSOR
44

- 45 A. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When
46 used in conjunction with a return air enthalpy sensor, the unit will provide
47 differential enthalpy control. The sensor allows the unit to determine if outside air is
48 suitable for free cooling.
49

50 PART 3 - EXECUTION
51

52 3.1 STARTUP
53

- 54 A. Provide the services of a factory trained service technician employed full time by the unit
55 manufacturer to start-up the system, or manufacturer's factory authorized representative

1 under the supervision of the factory trained service technician. Upon completion of the
2 installation, the system shall be started and commissioned by the manufacturer's factory
3 authorized representative who will verify a complete fully functional system. The factory
4 authorized representative will verify that accessories are installed and performing the
5 specified functions. (Contractor startup is unacceptable.)
6

7 B. The written startup report shall be provided to the owner and engineer upon completion.
8
9

END OF SECTION

SECTION 23 82 16

HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

- A. Submit manufacturer's product data sheets and unit capacity information as specified.
- B. Submit manufacturer's Installation, Start-Up and Service Instructions.
- C. Submit internal wiring diagram.
1. Electrical interlocks. *

1.3 RELATED WORK

- A. Division 23 Mechanical.
1. Air Handling Units.
2. Fan Coil Units.
3. Weatherproof Roof Mounted Air Handling Units.
4. Ductwork.
5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 DIRECT EXPANSION COOLING COILS

- A. DX cooling coils:
1. Constructed of copper tubes and aluminum fins.
2. Designed and circuited for use with direct expansion refrigeration.
- B. Cooling coil face velocity:
1. Not of magnitude to cause moisture to be carried off the coil.
2. Maximum velocity as scheduled.
- C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.
- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.2 ELECTRIC HEATERS

- A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.
- B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.

HEATING AND COOLING COILS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39

- C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.
- D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.
- E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.
- F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.
- G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.
- H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION

SECTION 23 82 18

DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with constant speed compressor, pre-charged with R410A refrigerant. air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

- A. Refrigerant Piping.
- B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

- A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.
- B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).
- C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.
- D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).
- E. A pressure charge of R410A refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.
- F. A dry air holding charge shall be provided in the indoor section.
- G. System efficiency shall meet or exceed 13.0 SEER.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier (Houston Direct Sales Office)
- B. Trane
- C. Mitsubishi Electric

2.2 INDOOR UNIT GENERAL

- A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.
- B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.
- C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.3 UNIT CABINET

- A. The casing shall have a smooth front, top return, in a Munsell No. 1.0Y 9.2/0.2 white finish.
- B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
- C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.4 FAN

- A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.
- B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
- C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).
- D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.
- E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.5 FILTER

- A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.6 COIL

- A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.
- B. Tubing shall have inner grooves for high efficiency heat exchange.
- C. All tube joints shall be brazed with PhosCopper or silver alloy.

- 1
2 D. The coil shall be pressure tested at the factory.
3
4 E. A sloped condensate pan and drain with extension hose shall be provided under the coil.
5 Drain connections shall be provided at each end of the drain pan. (Option: A condensate
6 mini-pump shall be provided to provide a means of condensate disposal when a gravity
7 drain is not available.)
8
9 2.7 ELECTRICAL
10
11 A. The unit shall be equipped with a micro-processor control system directing indoor and
12 outdoor unit coordinated operation.
13
14 B. The indoor unit shall not have any supplemental electrical heat elements.
15
16 2.8 CONTROL
17
18 A. This system shall have a wireless remote controller to perform input functions necessary
19 to operate the system. The controller shall consist of a Power On / Off switch, Mode
20 Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane Selector.
21
22 B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.
23
24 C. There shall be a 24 hour On / Off timer.
25
26 D. The unit shall have an emergency operation mode to allow operation without the remote
27 controller.
28
29 E. The microprocessor located in the indoor unit shall have the capability of sensing return
30 air temperature and indoor coil temperature, receiving and processing commands from
31 the wireless remote controller, providing emergency operation and controlling the
32 outdoor unit.
33
34 F. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.
35
36 G. The system shall be capable of automatic restart when power is restored after power
37 interruption.
38
39 H. The control system shall control the operation of the air sweep louvers, as well as provide
40 on / off and system / mode function switching.
41
42 2.9 OUTDOOR UNIT GENERAL
43
44 A. The outdoor unit is designed specifically for use with MS series indoor units. These units
45 are equipped with a circuit board that interfaces to the MS indoor unit circuit board. The
46 outdoor unit shall be completely factory assembled, internally piped and wired. Each unit
47 shall be run tested at the factory.
48
49 B. When refrigerant lines are exposed on exterior of building provide "LINE-HIDE" line set
50 cover system.
51 1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
52 2. Assembly Screws, stainless steel.
53
54 2.10 UNIT CABINET
55
56 A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically

- 1 applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.
- 2
- 3 B. Case and mounting feet shall be as follows:
- 4 1. The MS-A09WA base shall be of Aluminum-Zinc-Magnesium alloy coated
- 5 steel, with welded mounting feet.
- 6 2. The base for the MS-A12WA shall have a galvanized steel base with welded
- 7 mounting feet.
- 8
- 9 C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed
- 10 conditions for use in Hurricane condition areas. Mounting, base support, and other
- 11 installation to meet Hurricane Code Conditions shall be by others.
- 12
- 13 2.11 FAN
- 14
- 15 A. The unit shall be furnished with a directive drive propeller type fan, statically and
- 16 dynamically balanced for smooth and quiet operation.
- 17
- 18 B. The fan motor shall have inherent protection, be equipped with permanently lubricated
- 19 bearings. The fan motor shall be mounted and isolated for quiet operation.
- 20
- 21 C. The fan shall be provided with a raised guard to prevent contact with moving parts.
- 22
- 23 D. The outdoor unit shall have horizontal discharge airflow.
- 24
- 25 2.12 COMPRESSOR
- 26
- 27 A. The compressor shall be a high performance, hermetic, rolling piston, rotary type.
- 28
- 29 B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission
- 30 of vibration.
- 31
- 32 C. Compressor shall be protected by an automatic over current relay and a thermal overload
- 33 switch.
- 34
- 35 2.13 OPERATION
- 36
- 37 A. The outdoor unit shall have an accumulator.
- 38
- 39 B. The outdoor unit must have the ability to operate with a maximum height difference of 35
- 40 feet between indoor and outdoor units.
- 41
- 42 C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and
- 43 outdoor units without the need for line size changes, traps or additional oil. All refrigerant
- 44 lines must be insulated.
- 45
- 46 D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.
- 47
- 48 2.14 ELECTRICAL
- 49
- 50 A. The electrical power of the system shall be 115 volts, 1 phase, 60 hertz. The unit shall be
- 51 capable of satisfactory operation within voltage limits of 103 volts to 127 volts.
- 52
- 53 B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The
- 54 control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.
- 55

56 PART 3 - EXECUTION

1
2 3.1 INSTALLATION
3

4 A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as
5 recommended by the equipment manufacturer. Install refrigerant filter dryer and sight
6 indicating glass.
7

8 B. Install units on vibration isolation pads.
9

10 3.2 CONTROL WIRING
11

12 A. Furnish and install control wiring as required. Install control wiring in conduit.
13

14 3.3 DELIVERY, STORAGE AND HANDLING
15

16 A. Unit shall be stored and handled according to the manufacturer's recommendations.
17

18 B. The wireless controller shall be shipped inside the carton with the indoor unit and able to
19 withstand 105°F storage temperatures and 95% relative humidity without adverse effect.
20

21 3.4 WARRANTY
22

23 A. The units shall have a manufacturer's parts and defects warranty for a period five (5)
24 years from the date of the original installation. The compressor shall have a warranty of
25 seven (7) years from date of installation. If, during this period, any part should fail to
26 function properly due to defects in workmanship or material, it shall be replaced or
27 repaired at the discretion of the manufacturer. This warranty does not include labor.
28

29 3.5 START-UP
30

31 A. Follow the manufacturer's start-up procedures.
32

33 B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from
34 occurring on suction piping. After completion of successful start-up, installing contractor
35 shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket
36 over insulation exposed on exterior of building.
37

38 END OF SECTION

SECTION 23 82 39

ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install electric unit heaters complete with heating element, propeller mounting brackets and other options as specified.

1.2 RELATED WORK

- A. Division 23 - Mechanical.
 - 1. Electrical Provisions of Mechanical Work.
 - 2. Ductwork.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Modine
- B. Reznor
- C. Chromalox
- D. Trane
- E. Markel

2.2 COMPONENTS

- A. Casing:
 - 1. Construct casing of sheetmetal with a structural frame.
 - 2. Enamel or lacquer finish to manufacturers standard.
- B. Electric Heating Elements:
 - 1. Shall bear the UL label.
 - 2. Corrosion resistant materials.
 - 3. Heating coil of 80-20 nickel-chrome wire.
- C. Components:
 - 1. Fused control circuits
 - 2. Contactors in accordance with the staging requirements
 - 3. Control power transformer
 - 4. Control voltage 120
- D. Louvers:
 - 1. Adjustable vertical and horizontal louvers for air discharge.
- E. Mounting brackets:
 - 1. As indicated

2.3 CONTROLS

- 1 A. Automatic controls:
2 1. Factory mounted
3 2. Prewired to the junction box
4 3. Unit mounted thermostats 24-volt low voltage
5
6 B. Safety Controls:
7 1. A primary and secondary thermal cut-off to de-energize each circuit.
8 2. Manual reset high limit
9 3. Automatic reset thermal protection
10
11 2.4 FAN
12
13 A. Propeller blade fan:
14 1. Construct the fan of aluminum or other corrosion-resistant material.
15 2. Statically and dynamically balanced
16 3. Substantial fan guard
17
18 2.5 MOTOR
19
20 A. Totally enclosed ball bearing motor:
21 1. Permanently lubricated bearings
22 2. 120 volt, single phase, 60 cycle motor
23 3. Sized to operate the fan at the required capacity
24
25 2.6 ELECTRICAL
26
27 A. Single point connection:
28 1. Factory wiring
29 2. Only direct line supply and thermostat field connections
30 3. Terminal blocks for line voltage wiring
31 4. Wiring diagram permanently attached
32 5. Balance phases
33
34 PART 3 - EXECUTION
35
36 3.1 INSTALLATION
37
38 A. Furnish units with suitable connections for mounting as shown or as otherwise approved.
39
40 B. Provide start-up to ensure correct operation of unit.
41
42 C. Adjust discharge louvers to control direction of air flow.
43
44

END OF SECTION

SECTION 26 01 05

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates)
 - 9. Control operations / equipment wiring diagrams
 - 10. Coordination Drawings
 - 11. Schedule of Lamps, Light Engines
 - 12. Schedule of Ballasts and Drivers
 - 13. Schedule of Fuses
 - 14. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the completed manuals in final electronic form to the Architect / Engineer.
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
 - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Complete electronic manuals shall be delivered to the Owner prior to substantial completion.

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1"; Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11"
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems
 - 2) Control and flow diagrams

- b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
 1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Summer and winter operating instructions
 - 4) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Servicing and lubrication schedule
 - 1) List of lubricants required
 - e. Manufacturer's printed operating and maintenance instructions.
 - f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
 - 1) Electrical
 - 2) Controls
 - 3) Communications
 - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Predicted life of part subject to wear
 - 2) Items recommended to be stocked as spare parts
 - h. Schedule of fuses
 - i. Complete equipment field accessible internal wiring diagrams
 - j. Schedule of lamps
 - k. Schedule of ballasts
 - l. Each Contractor's coordination drawings
 - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
 - n. Other data as required under pertinent sections of the specifications
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective

- 1 sections of specifications
- 2 4. Provide complete information for products specified in Division 26.
- 3 5. Provide certificates of compliance as specified in each related section.
- 4 6. Provide start up reports as specified in each related section.
- 5 7. Provide signed receipts for spare parts and material.
- 6 8. Provide training report and certificates.
- 7

8 END OF SECTION

SECTION 26 05 00

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.
- B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Electrical work shall comply with applicable inspection services:
 - 1. Underwriters Laboratories
 - 2. National Fire Protection Association
 - 3. State Health Department
 - 4. Local Municipal Building Inspection Department adopted codes with amendments
 - 5. National Electrical Code with local amendments
 - 6. State Regulatory Agencies
 - 7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
 - 8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
 - 9. International Energy Conservation Code
 - 10. National Electrical Safety Code
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.
- B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
1. Underwriters Laboratories, Inc. (UL)
 2. Factory Mutual Research Corp. (FMRC) (also referred to as "Factory Mutual Global," or "FM Global")
 3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
 4. Canadian Standards Association (CSA)
 5. A complete listing of acceptable NRTLs is published on the OSHA website at <http://www.osha.gov/dts/otpca/nrtl/>.
- C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer's Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.
- D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner's AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.
- E. Codes and Standards applicable to this Division:
1. ANSI – American National Standards Institute
 - a. ANSI Z535.1, Safety Colors
 - b. ANSI Z535.2, Environmental and Facility Safety Signs
 - c. ANSI Z535.3, Criteria for Safety Symbols
 - d. ANSI Z535.4, Product Safety Signs and Labels
 2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
 - a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings* [ANSI, IESNA]
 3. ASTM – American Society for Testing and Materials
 4. CBM – Certified Ballast Manufacturers
 5. ICC – International Code Council
 - a. International Building Code® (IBC)
 - b. International Existing Building Code® (IEBC)
 6. ICEA – Insulated Cable Engineers Association
 - a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
 7. IEEE® - Institute of Electronics and Electrical Engineers
 - a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
 - b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plants* ("Red Book")
 - c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* ("Green Book")
 - d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* ("Gray Book")

- e. IEEE Std 242™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* (“Buff Book”)
- f. IEEE Std 315™, *Graphic Symbols for Electrical and Electronics Diagrams*
- g. IEEE Std 399™, *Recommended Practice for Power Systems Analysis* (“Brown Book”)
- h. IEEE Std 446™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* (“Orange Book”)
- i. IEEE Std 493™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* (“Gold Book”)
- j. IEEE Std 519™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
- k. IEEE Std 739™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* (“Bronze Book”)
- l. IEEE Std 902™, *Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems* (“Yellow Book”)
- m. IEEE Std 1015™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems* (“Blue Book”)
- n. IEEE Std 1100™, *Recommended Practice for Powering and Grounding Electronic Equipment* (“Emerald Book”)
- o. IEEE Std 1584™, *Guide for Performing Arc-Flash Hazard Calculations*
8. IESNA – Illuminating Engineering Society of North America
 - a. IESNA *Lighting Handbook*, Ninth Edition
 - b. IESNA RP-1, *American National Standard Practice for Office Lighting*
 - c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
9. NECA – National Electrical Contractors Association:
 - a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
 - b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
 - c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
 - d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
 - e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]
 - f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
 - g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
 - h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)* [ANSI]
 - i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
 - j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
 - k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
 - l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]
 - m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
 - n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]
 - o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
 - p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]

- q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
- r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
- s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI)
- t. NECA 420, *Standard for Fuse Applications* [ANSI]
- u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
- v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting Systems* [ANSI]
- w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]
- x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]
- y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]
- z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]
- 10. NEMA – National Electrical Manufacturers Association
- 11. NETA – International Electrical Testing Association, Inc.:
 - a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
 - b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
 - c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
- 12. NFPA – National Fire Protection Association:
 - a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection*®
 - b. NFPA 70™, *National Electrical Code*® (NEC®)
 - c. NFPA 70E, *Standard for Electrical Safety in the Workplace*.
 - d. NFPA 101®, *Life Safety Code*®
 - e. NFPA 110, *Standard for Emergency and Standby Power Systems*
 - f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
 - g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
 - h. All other NFPA codes and standards except NFPA 5000
- 13. OSHA – Occupational Safety and Health Administration
- 14. IECC – International Energy Conservation Code
- 15. ISO – International Organization for Standardization
- 16. State and Local Energy Conservation Code
- 17. Applicable County and Municipal Codes

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and

equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.

- C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.
- D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.
- E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
 - 1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 - 2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
 - 3. Three sets of blue-line prints of each contract as-built drawing.
 - 4. Three sets of pdf prints of each contract as-built drawing on CD.
- C. As-Built Drawings should indicate the following information as a minimum:
 - 1. Indicate all addendum changes to documents.
 - 2. Remove Engineer's Seal, name, address, and logo from drawings.
 - 3. Mark documents RECORD DRAWINGS.
 - 4. Clearly indicate: DOCUMENT PRODUCED BY:
 - 5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
 - 6. Indicate exact location of all underground electrical raceways, and elevations.
 - 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 - 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.

9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all electrical equipment in and outside of the building.
11. Exact location of all outdoor lighting poles and equipment.
12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
14. Cloud all changes.
15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
 1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
 2. The responsibility for alignment of motor and driven equipment is specified in the related division.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.9 CONCEALED AND EXPOSED WORK

- 1 A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or
2 above ceilings. "Exposed" is defined as open to view, in plain sight.
3
- 4 1.10 GUARANTEE
5
- 6 A. Guarantee work for 1 year from the date of substantial completion of the project. During that
7 period make good any faults or imperfections that may arise due to defects or omissions in
8 material, equipment or workmanship. Replacement of failed parts or equipment shall be
9 provided.
10
- 11 1.11 MATERIAL AND EQUIPMENT
12
- 13 A. Furnish new and unused materials and equipment meeting the requirements of the paragraph
14 specifying acceptable manufacturers. Where two or more units of the same type or class of
15 equipment are required, provide units of a single manufacturer.
16
- 17 1.12 NOISE AND VIBRATION
18
- 19 A. Select equipment to operate with minimum noise and vibration. If noise or vibration is
20 produced or transmitted to or through the building structure by equipment, piping, ducts or
21 other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify
22 such conditions at no additional cost to the Owner. If the item of equipment is judged to
23 produce objectionable noise or vibration, demonstrate at no additional cost that equipment
24 performs within designated limits on a vibration chart.
25
- 26 1.13 ACCEPTABLE MANUFACTURERS
27
- 28 A. Manufacturers names and catalog number specified under sections of Division 26 are used to
29 establish standards of design, performance, quality and serviceability and not to limit
30 competition. Equipment of similar design, materials, energy efficiency characteristics (where
31 applicable) and lighting performance characteristics (where applicable) equal to that specified,
32 manufactured by a named manufacturer shall be acceptable on approval. A request for prior
33 approval of equipment not listed must be submitted ten (10) days before proposal due date.
34 Submit a marked-up set of the relevant specification section indicating all variances, a
35 comparison to the specified product, and of construction and performance criteria, complete
36 design and performance data for the specified product and the proposed substitution for
37 comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as
38 addenda to the Construction Proposal Documents.
39
- 40 1.14 UTILITIES, LOCATIONS AND ELEVATIONS
41
- 42 A. Locations and elevations of the various utilities included within the scope of this work:
43 1. Obtained from utility maps and other substantially reliable sources.
44 2. Are offered separate from the Contract Documents as a general guide only without
45 guarantees to accuracy.
46
- 47 B. Examine the site and verify the location and elevation of all utilities and of their relation to the
48 work. Existing utilities indicated on the site plans are for reference only and shall be field
49 verified by the Contractor with the respective public or private utility.
50
- 51 1.15 OPERATING TESTS
52
- 53 A. After all electrical systems have been completed and put into operation, subject each system
54 to an operating test under design conditions to ensure proper sequencing and operation
55 throughout the range of operation. Tests shall be made in the presence of the Architect /
56 Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests.

Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

- A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.
- B. Manufacturer's warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.
- C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

- A. General: Refer to Division 1 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

- A. Identification of Equipment:
 - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
 - 2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer devices not installed inside light fixtures, wireway, busduct

- plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
- a. Utility Power: White letters on black background
Generator Power (White letters on red background)
UPS Power: White letters on blue background
Load Bank Circuits: White letters on green background
Solar or Wind Power Generation: White on orange background
 - b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "PANEL HA –fed from MDP-6 located in Mech. Rm. 100"). The words "fed from" and "located" shall be included in the labeling.
Example: Panel HA
Fed From MSB
Located Main Elec. RM 100
Example: Disconnect for Panel LK
Location: Kitchen
Fed From Transformer TLK
Located Main Elec. RM 100
 - c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in 1/4-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
 - d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel "HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100")
 - e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
 - f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1 West Parking Lot Pole Lights Fed From Panel HA-2,4,6 Located Main Elec. Rm. 100 Control Circuit-Panel LA 42 Located Main Elec. Rm. 100 Controlled-BMCS	Receptacle Contactor C2 Table Recpts Lab Rm 100 Fed From Panel LA-2,4,6,8 Located Mech. Rm. 110 Control Circuit-Panel LA-42 Controlled-Emer Shut Off Mushroom Switch Rm 101
GTD Example	
Exterior lighting wall packs / north soffit / west metal canopy Fed from Panels EHA-2 located	

in Elec. RM 105 and HA-1 via Lighting Contactor controlled by BMCS located in Elec. RM 200.	
---	--

- g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A
- h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.
- i. Panel names for 277/480v shall start with the letter “H” and 120/208v, 120/240v shall start with the letter “L”. No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner’s electrical representative. Panel names shall not include the letter “I”. Transformer names shall start with the letter “T” followed by the panel name it serves, i.e. TLA.
- j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.
- | | |
|---------------------------|-----------------------------------|
| Main Service ATS Example | Wall Mounted Lighting ATS Example |
| ATS-1 | ATS |
| Emer Power-Emer Generator | Exterior Wall Packs/Soffit Lights |
| Located Chiller Yard | North/West Metal Canopy Lights |
| Normal Power-MSB | Fed from EHA-2 |
| Located-Mech Rm 100 | Located Mech Rm 200 |
| Serves Panel EHA | Fed From HB-4 |
| Located-Mech Rm 100 | Located Mech Rm 150 |
- k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.
- l. Switchgear, switchboards, panelboards, motor control centers, or service equipment available fault current labeling: Provide a 2x3 inch permanently affixed (notice) label with white lettering on contrasting blue background permanently affixed to the equipment prior to energizing the equipment. The label shall include the date of installation and the date of calculation and comply with ANSI Z535.4 current standards design and durability. The date of calculation shall be the date indicated by the Engineer of Record’s seal on the Construction Documents. Example:

AVAILABLE FAULT CURRENT: ##, ### AMPS
DATE OF INSTALLATION: MM/DD/YY
DATE OF CALCULATION: MM/DD/YY

3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as “corridors”. Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a

- 1 contactor, list exact location of contactor, and how switched. Do not use architectural
2 room number designation shown on plans. Obtain final graphics room number
3 identification from Architect's final room number graphics plan. All locations served
4 by breakers shall be listed on schedule. Panel schedule shall be large enough to
5 contain all information required. Also refer to Section 26 24 16.
- 6 4. Permanent, waterproof, black markers shall be used to identify each lighting and
7 power grid junction box, gutter and wireway. Clearly indicate the panel and branch
8 circuit numbers available at that junction box, gutter or wireway. Where low voltage
9 relay panels are used for lighting control, identify the low voltage relay panel and
10 number in addition to the branch circuit panel and number.
- 11 5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name
12 plate showing identity, voltage and phase and identifying equipment connected to it.
13 The transformer rating shall be shown on the panels or enclosures. For an enclosure
14 containing a motor starter, the nameplate shall include the Owner's motor number,
15 motor voltage, number of motor phases, motor load being serviced, motor
16 horsepower, and motor full load current. Nameplates shall also indicate where panel
17 is fed from.
- 18
- 19 B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source
20 from whom the material has been obtained are prohibited for installation in public, tenant, or
21 common areas within the project. Also prohibited are materials or devices that bear evidence
22 that markings or insignias have been removed. Certification, testing (example, Underwriters
23 Laboratories), and approval labels are exceptions to this requirement.
- 24
- 25 C. Warning Signs: Provide warning signs where there is hazardous exposure associated with
26 access to or operation of electrical facilities. Provide text of sufficient size to convey adequate
27 information at each location; mount permanently in an appropriate and effective location.
28 Comply with industry standards for color and design.
- 29
- 30 D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except
31 in manholes provide stainless steel with plastic ties.
- 32
- 33 E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes,
34 gutters, wireways, contactors, and motor controllers and load connection. Identify with
35 panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and
36 with control wire number as indicated on equipment manufacturer's shop drawings for control
37 wiring.
- 38
- 39 F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape,
40 colored red for 50 volts or above electrical, or orange for communications and control with
41 suitable warning legend describing buried electrical lines; telephone lines and data lines per
42 APWA recommendations. All underground electrical conduits shall be so identified. Tape
43 shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks.
44 Provide magnetic marking tape below all underground electrical conduits.
- 45
- 46 G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼"
47 high white letters on ½" tall black background for digital lighting modules as "DLM".
48 Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay
49 location. Modules or relays located in mechanical or electrical rooms or other areas other than
50 above ceiling: Adhere label to the cover of the module or relay and identify the area they
51 control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting
52 control switches or push button stations located remotely from the area they control: Adhere
53 label to device face plate, not obstructing screw fasteners, and intuitively identify function
54 such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.
- 55

56 3.2 CUTTING AND PATCHING

ELECTRICAL GENERAL PROVISIONS

- 1
2 A. General: Comply with the requirements of Division 1 for the cutting and patching of other
3 work to accommodate the installation of electrical work. Except as authorized by the
4 Architect / Engineer, cutting and patching of electrical work to accommodate the installation
5 of other work is not permitted.
6

7 3.3 INSTRUCTION OF OWNER'S PERSONNEL
8

- 9 A. Prior to substantial completion, conduct an on-site training program to instruct Owner's
10 operating personnel in the operation and maintenance of the electrical systems.
11 1. Provide the training during regular working day.
12 2. The Instructors shall be experienced in their phase of operation and maintenance of
13 the electrical systems and with the project.
14 3. Refer to other specification sections for additional training and commissioning
15 requirements.
16
17 B. Time to be allocated for instructions.
18 1. Minimum of 20 hours dedicated instructor time
19 2. 4 hours on each of 5 days
20 3. Additional instruction time for specific systems as specified in other Sections.
21
22 C. Before on-site training, submit the program syllabus; proposed time and dates; for review and
23 approval, minimum 48 hours prior to proposed training time and date.
24 1. One copy to the Owner
25 2. One copy to the Architect / Engineer
26
27 D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their
28 attendance at the agreed upon times.
29
30 E. Use operation and maintenance manuals as the basis of instruction. Review manual with
31 personnel in detail. Explain all aspects of operation and maintenance.
32
33 F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing,
34 maintenance, and shut down of each item of equipment.
35
36 G. Demonstrate equipment functions (both individually and as part of the total integrated
37 system).
38
39 H. Prepare and insert additional data in the operating and maintenance manuals when the need
40 for additional data becomes apparent during instructions.
41
42 I. Submit a report within one week after completion of training. List time and date of each
43 demonstration, hours devoted to the demonstration, and a list of people present, with their
44 respective signatures.
45
46 J. At the conclusion of the on-site training program, have the person designated by the Owner
47 sign a certificate to certify that he / she has a proper understanding of the system, that the
48 demonstrations and instructions have been satisfactorily completed, and the scope and content
49 of the operating and maintenance manuals used for the training program are satisfactory.
50
51 K. Provide a copy of the report and the certificate in an appropriately tabbed section of each
52 Operating and Maintenance Manual.
53

54 3.4 OPENINGS
55

- 1 A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other
2 divisions. Drawings and layout work for exact size and location of all openings are included
3 under this division.
4
- 5 3.5 HOUSEKEEPING PADS
6
- 7 A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical
8 equipment.
9
- 10 B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.
11
- 12 C. Concrete pads:
13 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match
14 existing if indicated on the drawings to extend existing pads, or in other sections of
15 the specifications.
16 2. Chamfer strips at edges and corner of forms.
17 3. Smooth steel trowel finish.
18 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise
19 shown.
20 5. 6-inch x 6-inch #8 wire reinforcement mesh.
21
- 22 3.6 OBSTRUCTIONS
23
- 24 A. The drawings indicate certain information pertaining to surface and subsurface obstructions,
25 which has been taken from available drawings. Such information is not guaranteed, however,
26 as to accuracy of location or complete information.
27 1. Before any cutting or trenching operations are begun, verify with Owner's
28 representative, utility companies, municipalities, and other interested parties that all
29 available information has been provided.
30 2. Should obstruction be encountered, whether shown or not, alter routing of new work,
31 reroute existing lines, remove obstruction where permitted, or otherwise perform
32 whatever work is necessary to satisfy the purpose of the new work and leave existing
33 services and structures in a satisfactory and serviceable condition.
34
- 35 B. Assume total responsibility for and repair any damage to existing utilities or construction,
36 whether or not such existing facilities are shown.
37
- 38 3.7 VANDAL RESISTANT DEVICES
39
- 40 A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2
41 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.
42
- 43 B. Proof of delivery of these items to the Owner shall be included in the Operating and
44 Maintenance Manuals.
45
- 46 3.8 PROTECTION
47
- 48 A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean
49 and in original manufacturer's condition.
50
- 51 B. Do not deliver equipment to this project site until progress of construction has reached the
52 stage where equipment is actually needed or until building is closed in enough to protect the
53 equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the
54 contractor is obligated to furnish new equipment of a like kind at no additional cost to the
55 Owner.
56

1 3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

- 2
- 3 A. Review with equipment specified which requires electrical connections. Review equipment
- 4 shop drawings and manufacturer's nameplate data and coordinate exact branch circuit
- 5 overcurrent protective device and conductors with equipment provided.
- 6 1. Provide equipment manufacturer's recommended overcurrent protective device
- 7 indicated on nameplate at no additional cost to the Owner.
- 8 2. If branch circuit conductors and / or conduit sizing is less than the minimum required
- 9 by equipment manufacturer, notify the Architect / Engineer immediately, prior to
- 10 rough-in.
- 11 3. If equipment manufacturer is a substitution to the specified equipment manufacturer,
- 12 provide the greater of the conductors specified or those required for the installed
- 13 equipment manufacturer's minimum circuit conductors, at no additional cost to the
- 14 Owner.
- 15 4. If conductors indicated on plans are in excess of that permitted by equipment
- 16 manufacturer, notify Architect / Engineer immediately, prior to rough-in.
- 17 5. If conductors indicated on plans are in excess of that permitted by the equipment
- 18 manufacturer, provide the maximum conductors permitted by the equipment
- 19 manufacturer based on NEC ampacity tables, either in a single set, or as a set of
- 20 parallel conductors as permitted by the NEC. Conductor size and quantity entering
- 21 the equipment enclosures shall not exceed the equipment manufacturer's maximum
- 22 recommendations.
- 23

24 3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE

25 COORDINATION

26

- 27 A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study
- 28 report for new electrical distribution equipment downstream to the last new overcurrent
- 29 device in each feeder or branch circuit, conducted and prepared by the switchgear
- 30 manufacturer. The coordination study and fault current analysis shall include the
- 31 manufacturer's recommendations for all adjustable overcurrent devices specified or provided.
- 32 Study does not require inclusion of existing switchgear, except it shall include existing or new
- 33 overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit
- 34 the report results prior to submitting switchgear submittals to allow changes or modifications
- 35 to equipment selection.
- 36
- 37 B. Contractor shall adjust all overcurrent device settings based on manufacturer's
- 38 recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings
- 39 for GFI shall be set at maximum as permitted by the NEC.
- 40
- 41 C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning
- 42 labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor
- 43 control centers, panelboards, motor controllers, safety switches, industrial control panels and
- 44 other equipment that is likely to require examination, adjustment, servicing, or maintenance
- 45 while energized. Locate the marking to be clearly visible to qualified persons before
- 46 examination, adjustment, servicing, or maintenance of the equipment. On renovation projects,
- 47 install arc-flash warning labels on existing equipment where lock-out / tag-out will be
- 48 required for the renovation work. Provide the information listed below on each label. Specify
- 49 that arc-flash warning label information be produced by the electrical equipment manufacturer
- 50 or supplier as a part of the final power system studies to be submitted by the Contractor in
- 51 accordance with the electrical acceptance testing.
- 52 1. Note: In addition to the final arc-flash analysis, the final power system studies
- 53 include load flow and fault-current calculations, and an overcurrent protective device
- 54 (OCPD) coordination study based on the actual equipment to be installed for the
- 55 project.
- 56

- 1 D. Information to be determined and applied to electrical equipment:
 - 2 1. Arc-Flash Protection Boundary
 - 3 2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841 TM
 - 4 3. Working distance calculated in accordance with IEEE Std 1584a TM
 - 5 4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective
 - 6 equipment (PPE) for operations with doors closed and covers on.
 - 7 a. Typical operations include operating circuit breakers, fused switches, and
 - 8 meter selector switches.
 - 9 5. System phase-to-phase voltage
 - 10 6. Condition(s) when a shock hazard exists (e.g. "With cover off")
 - 11 7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 - 12 8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 - 13 9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
 - 14 10. Unique equipment designation or code (described under "Component Identification")
 - 15 11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
 - 16 12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
 - 17 13. Date that the hazard analysis was performed.
 - 18 14. "Served from" circuit directory information including the serving equipment
 - 19 designation, location (e.g., room number), circuit number, and circuit voltage /
 - 20 number of phases / number of wires.
 - 21 15. If applicable, the "serves" circuit directory information including the served
 - 22 equipment designation, location (e.g., room number), circuit number, and circuit
 - 23 voltage / number of phases / number of wires.
 - 24 16. An abbreviated warning label may be used where it has been determined that no
 - 25 dangerous arc-flash hazard exists in accordance with IEEE 1584a TM, paragraph
 - 26 9.2.3.
 - 27 17. Use a "DANGER" label where the calculated arc-flash incident energy exceeds 40
 - 28 cal/cm.
 - 29
- 30 E. Submittals: Submit four copies of coordination study and certified fault current study results
- 31 to the Architect for review.
- 32
- 33 3.11 EQUIPMENT BACKBOARDS
- 34
- 35 A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
 - 36 1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone
 - 37 equipment terminal location.
 - 38 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice /
 - 39 video / communications equipment location / cable TV head end equipment, or
 - 40 security equipment location.
 - 41
- 42 3.12 TESTING
- 43
- 44 A. The contractors for the various sub-systems shall submit proposed testing procedures for their
- 45 systems, subject to review and approval and Owner acceptance. The contract will not be
- 46 declared to be substantially complete until the functional operation of the subsystems have
- 47 been demonstrated and verified and reports have been provided, reviewed and accepted.
- 48
- 49 B. The project will not be declared substantially complete until the following has taken place.
 - 50 1. The "As-Built" drawings have been submitted, reviewed and accepted by the
 - 51 Architect / Owner / Owner's Construction Representative.
 - 52 2. The building emergency lighting system and other systems including but not limited
 - 53 to those listed below have been tested, completed factory start-up and programming
 - 54 and adjusting as required for a complete and fully operational system acceptable to
 - 55 the Architect and Owner.
 - 56 a. Occupancy Sensor and Lighting Controls

- b. Surge protective device equipment
- c. Overcurrent devices
- d. Motor Controllers
- e. Emergency Lighting
- f. Building Fire Alarm System
- g. Clock System
- h. Television Distribution System
- i. Building Data / Voice Cabling System
- j. Surveillance and Security System
- k. Intercom / Telephone
- l. Sound Reinforcement Systems
- m. Building Lightning protection System

3.13 LOAD BALANCING

- A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, "Motor Tip Sheet #7" dated September 2005 available for download to PDF format at no charge at:
http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systems7.pdf

END OF SECTION

SECTION 26 05 05

ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.

- D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.
- E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
- B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminaire that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures
- C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Panelboards Reused and Modified for Renovation: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.
- C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and

connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.

- D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.
- E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
 - 1. Remove exposed conduit that has been abandoned.
 - 2. Cap conduit beyond the finish line.
 - 3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.
- F. Where new/existing luminaries or devices are shown being connected to existing circuits:
 - 1. Field verify existing system voltage
 - 2. Provide ballast / device to match system voltage
- G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch circuit shall not exceed 80% of its rating.
- H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.
- I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

- 1 N. Existing Data Network: Maintain existing system in service. Disable system only to
2 make switchovers and connections. Notify the Owner at least 72 hours before partially or
3 completely disabling system. Minimize outage duration. Make connections to maintain
4 service in areas adjacent to work area.
5
6 O. Existing Video Distribution System: Maintain existing system in service. Disable
7 system only to make switchovers and connections. Notify the Owner at least 72 hours
8 before partially or completely disabling system. Minimize outage duration. Make
9 connections to maintain service in areas adjacent to work area.
10
11 P. Existing Security System: Maintain existing system in service. Disable system only to
12 make switchovers and connections. Notify the Owner at least 72 hours before partially or
13 completely disabling system. Minimize outage duration. Make connections to maintain
14 service in areas adjacent to work area.
15
16 Q. Existing Video Surveillance System: Maintain existing system in service. Disable
17 system only to make switchovers and connections. Notify the Owner at least 72 hours
18 before partially or completely disabling system. Minimize outage duration. Make
19 connections to maintain service in areas adjacent to work area.
20

21 3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
22

- 23 A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated
24 on the drawings or required by the installation of new facilities. All removals and/or
25 dismantling shall be conducted in a manner as to produce maximum salvage. Salvage
26 materials shall remain the property of the Owner, and shall be delivered to such
27 destination as directed by the Owner's representative unless they are not wanted, then it
28 will be the responsibility of this Contractor to remove such items and properly dispose of
29 them. Materials and/or items scheduled for relocation and which are damaged during
30 dismantling or reassembly operations shall be repaired and restored to good operative
31 condition. The Contractor may, at his discretion, and upon approval of the Owner's
32 representative substitute new materials and/or items of like design and quality in lieu of
33 materials and/or items to be relocated.
34 1. Remove abandoned electrical distribution equipment, utilization equipment,
35 outlets and accessible portions of wiring, raceway systems, and cables back to
36 the source panelboard, switchboard, switchgear, communications closet, or
37 cabinet. Abandoned wiring and raceways can result from actions that include the
38 following:
39 a. Equipment is removed or relocated
40 b. Fixtures are removed or relocated
41 c. System is no longer used
42 d. There is no demonstrable near term future use for the existing circuit or
43 raceway system.
44 2. Leave abandoned electrical equipment, conductors, and material in place only if
45 one or more of the following conditions exist:
46 a. The removal requires the demolition of other structures, finishes, or
47 equipment that is still in use. An example is abandoned conduit above
48 an existing plaster ceiling.
49 b. Removal is not feasible due to hazards, construction methods, or
50 restricted access.
51 c. Removal of abandoned conductors may damage conductors that must
52 remain operational.
53 3. Remove conduits, including those above accessible ceilings, to the point that
54 building construction, earth, or paving covers them. Cut conduit beneath or flush
55 with building construction or paving. Plug, cap, or seal the remaining unused
56 conduits. Install blank covers for abandoned boxes and enclosures not removed.

4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
 5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
 6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers, and other accessories.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.
- I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- K. Existing conduit raceway found to need additional hangers installed and/or junction box

covers shall be added at no additional cost to the Owner.

- L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description "existing". Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

3.7 TESTING AND CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Pre-construction testing of existing low voltage systems:
 - 1. Provide a complete operational test of the following systems prior to demolition and renovation. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be performed by a contractor and technicians, each certified by the respective manufacturer of the existing special system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
 - a. Paging System.
 - b. Telephone System
 - c. Fire Alarm System
 - d. Data Network Communications System
 - e. Video Distribution System
 - f. Security Access Control System
 - g. Video Surveillance System.
 - h. Sound Reinforcement System
 - 2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and individuals performing the tests. Provide the written report within 14 days of notice to proceed and prior to any demolition or renovation work.
- B. Substantial completion testing of existing low voltage systems:
 - 1. Provide complete operational tests of the following systems within 14-days prior to estimated date of substantial completion. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be performed by a contractor and technicians each certified by the

respective manufacturer of the existing system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:

- a. Paging System.
 - b. Telephone System
 - c. Fire Alarm System
 - d. Data Network Communications System
 - e. Video Distribution System
 - f. Security Access Control System
 - g. Video Surveillance System.
 - h. Sound Reinforcement System
2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and each individual performing the tests. Provide the written report within 14 days of expected date for substantial completion.

C. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:

1. Notify the Owner immediately of any disruption or damage to any low voltage system.
2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
3. For each low voltage system other than access control or fire alarm system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION

SECTION 26 05 08

TELECOMMUNICATIONS, CATV, VOICE, DATA, VIDEO UTILITY COORDINATION
AND SERVICE ENTRANCE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. General: Provide infrastructure, conduit, ductbanks and pathways from public street right-of-way to building for telecommunications, CATV, voice, data, and video.
- B. Utility Company Data: Obtain from utility company information and installation standards for telecommunication, CATV, voice, data, video service installation.
- C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Utility Data: Ensure that utility company service data is accurate and verified.

2.2 UTILITY INFRASTRUCTURE

- A. General: Division 26 shall make provisions for utilities as required by utility company, including, but not limited to permanent or removable/lockable vehicular barriers, grounding rods, grounding conductors, sleeves, conduits, concrete ductbanks, pull boxes and manholes.
- B. The utility company shall provide cabling and connections to the Owner's demarcation point of service.
- C. Coordinate communications pathway with Division 27.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company's specific construction requirements for this project, and with requirements of this Division.
- B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.
- C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.
- D. The materials and labor required by the utility company that shall be provided by the contractor includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, concrete reinforced ductbanks, conduits, racks and metering enclosures, pull boxes and manholes.
- E. Utility pole and utility conduits and/or ductbank locations shall be staked and surveyed prior to utility installations by the Contractor to verify their proper placement is within the Owner's

TELECOMMUNICATIONS, CATV, VOICE, DATA, VIDEO UTILITY COORDINATION
AND SERVICE ENTRANCE

1 property and respective utility easements. Contractor shall verify by survey that the pole,
2 conduit and ductbank location and easements do not interfere with existing easements, right-
3 of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall
4 be brought to the attention of the Architect prior to construction.
5

- 6 F. Contractor shall initiate contact with the utility provider and Owner within 14 days of Notice
7 to Proceed to ensure all utilities will be available to the site. Any delays resulting from lack of
8 this coordination shall be the responsibility of the Contractor.
9

10
END OF SECTION

SECTION 26 05 10

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide manufacturer's qualified personnel to observe:
 - 1. Field conditions
 - 2. Condition of installation
 - 3. Quality of workmanship
 - 4. Start-up of equipment
 - 5. Testing, adjusting, and balancing of equipment

CONTRACT QUALITY CONTROL

- 1 B. Manufacturer's qualified personnel shall make written report of observations and
2 recommendations to Architect / Engineer.

3
4 1.7 MOCK UPS

- 5
6 A. Assemble and erect the specified equipment and products complete, with specified anchorage
7 and support devices, seals and finishes.
8
9 B. Do not proceed with any work involving a mock-up, until the related mock up has been
10 approved in writing.
11
12 C. Acceptable mock-ups in place shall be retained in the completed work where possible.
13
14 D. Perform tests and submit results as specified.

15
16 1.8 SCHEDULING OF MOCK-UPS

- 17
18 A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
19 1. Rough-in
20 2. Finish with all appurtenances in place
21 3. Demonstrations
22
23 B. Refer to other specification sections for pre-functional checklist for requirements to aid in
24 preparing mock-ups.
25

26 PART 2 - PRODUCTS

27
28 2.1 EQUIPMENT AND MATERIAL

- 29
30 A. Comply with recognized National rating and approval agencies as well as all codes and
31 ordinances at the federal, state and city levels.
32

33 PART 3 - EXECUTION

34
35 3.1 ADJUSTMENTS AND MODIFICATIONS

- 36
37 A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's
38 qualified personnel at no additional cost to Owner.
39
40 B. Coordination Drawings:
41 1. Electrical room size and location required and to scale
42 2. Equipment and accessories, switchgear and piping
43 3. Indicate clearances and service access.
44

45 3.2 ELECTRICAL ACCEPTANCE TESTING

- 46
47 A. Perform electrical acceptance testing and inspections in accordance with the current edition of
48 the International Electrical Testing Association (NETA), *Acceptance Testing Specification*
49 (ATS).
50
51 B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed
52 electrical systems and components, both Contractor and user-supplied are:
53 1. Installed in accordance with design documents and manufacturer's instructions.
54 2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA
55 110 and NFPA 111).
56 3. Ready to be energized.

4. Operational within industry and manufacturer's tolerances.

3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

- A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

3.4 MOCK-UPS

- A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.
- B. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, all lighting controls, covers plates, rough-in boxes, conduits, MC cables, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit or MC Cable routing and conductor fill.
- C. Mock up a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.
- D. Mock up ten feet of cable tray including all supports, hardware and bonding.

END OF SECTION

SECTION 26 05 12

ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
 - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
 - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
 - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
 - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

3.2 COMPOSITE COORDINATION DRAWINGS

- A. Produce a set of composite coordinate drawings for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security and CCTV systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping and a composite above-ceiling plan, below slab coordination drawings, and a composite mechanical and electrical equipment room floor plan.
1. Prepare the composite plans at one-quarter inch (1/4") equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
 2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
 3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
 4. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- B. Submit composite coordination shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.
1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
 2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
 3. Submit coordination and shop drawings prior to rough-in and fabrication.

3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submittal Specification Information:
1. Every submittal document shall bear the following information as used in the project manual:
 - a. The related specification section number
 - b. The exact specification section title
 2. Submittals delivered to the Architect / Engineer without the specified information

will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

- C. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- D. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- E. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as necessary for reference.
- I. Identify field dimensions; show relation to adjacent or critical features or work or products.
- J. Submit individually bound shop drawings and product data for the following when specified or provided. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other switchgear.
 - 1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis three (3) weeks prior to any overcurrent device submittal to allow modifications to overcurrent device product selection submittal based on the manufacture's analysis and recommendations at no additional cost to the Owner.
 - 2. Enclosed Switches and Circuit Breakers
 - 3. Enclosed Motor Controllers
 - 4. Panelboards, load centers, and enclosures
 - 5. Wiring devices
 - 6. Lighting fixtures
 - 7. Lighting Controls and Occupancy Sensors
 - 8. Surge Protection Devices
 - 9. Site Lighting Poles, Fixtures, Drivers, and Lamps
 - 10. Electrical controls and time switches
 - 11. Electrical Contactors
 - 12. Transformers
 - 13. Switchboards
 - 14. RTRC and/or PVC coated galvanized steel conduit and fittings conduit and fittings
 - 15. Emergency/Standby generator sets and transfer switches and roll-up generator box.
 - 16. Theatrical Lighting Systems
 - 17. Electrical cable trays
 - 18. Sports Lighting Equipment, Fixtures, Poles, Ballast and Lamps

3.4 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1 3.5 CONTRACTOR RESPONSIBILITIES

- 2
- 3 A. Review submittals prior to transmittal.
- 4
- 5 B. Determine and verify:
- 6 1. Field measurements
- 7 2. Field construction criteria
- 8 3. Manufacturer's catalog numbers
- 9 4. Conformance with requirements of Contract Documents
- 10
- 11 C. Coordinate submittals with requirements of the work and of the Contract Documents.
- 12
- 13 D. Notify the Architect / Engineer in writing at time of submission of any deviations in the
- 14 submittals from requirements of the Contract Documents.
- 15
- 16 E. Do not fabricate products, or begin work for which submittals are specified, until such
- 17 submittals have been produced and bear contractor's stamp. Do not fabricate products or begin
- 18 work scheduled to have submittals reviewed until return of reviewed submittals with
- 19 Architect / Engineer's acceptance.
- 20
- 21 F. Contractor's responsibility for errors and omissions in submittals is not relieved whether
- 22 Architect / Engineer reviews submittals or not.
- 23
- 24 G. Contractor's responsibility for deviations in submittals from requirements of Contract
- 25 Documents is not relieved whether Architect / Engineer reviews submittals or not, unless
- 26 Architect / Engineer gives written acceptance of the specific deviations identified by the
- 27 Contractor on reviewed documents.
- 28
- 29 H. Submittals shall show sufficient data to indicate complete compliance with Contract
- 30 Documents:
- 31 1. Proper sizes and capacities
- 32 2. That the item will fit in the available space in a manner that will allow proper service
- 33 3. Construction methods, materials and finishes
- 34
- 35 I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the
- 36 Contractor for processing or for making corrections for re-submittal.
- 37
- 38 J. Contractor's Stamp of Approval
- 39 1. Contractor shall stamp and sign each document certifying to the review of products,
- 40 field measurements and field construction criteria, and coordination of the
- 41 information within the submittal with requirements of the work and of Contract
- 42 Documents.
- 43 2. Contractor's stamp of approval on any submittal shall constitute a representation to
- 44 Owner and Architect / Engineer that Contractor has either determined and verified
- 45 all quantities, dimensions, field construction criteria, materials, catalog numbers, and
- 46 similar data or assumes full responsibility for doing so, and that Contractor has
- 47 reviewed or coordinated each submittal with the requirements of the work and the
- 48 Contract Documents.
- 49 3. Do not deliver any submittals to the Architect / Engineer that do not bear the
- 50 Contractor's stamp of approval and signature.
- 51 4. Submittals delivered to the Architect / Engineer without Contractor's stamp of
- 52 approval and signature will not be processed. The Contractor shall bear the risk of all
- 53 delays, as if no submittal had been delivered.
- 54

55 3.6 SUBMISSION REQUIREMENTS

56

- 1 A. Make submittals promptly in accordance with approved schedule, and in such sequence as to
2 cause no delay in the Project or in the work of any other Contractor. Product and equipment
3 related to site work or other trades which require extensive rough-in, foundations, or structural
4 support shall be submitted as soon as possible after given notice to proceed with construction.
5
6 B. Number of submittals required:
7 1. Shop Drawings and Coordination Drawings: Submit one electronic data file (pdf)
8 and three opaque reproductions.
9 2. Product Data: Submit the number of copies the contractor requires, plus those to be
10 retained by the Architect / Engineer, and/or electronic data (pdf) files.
11
12 C. Accompany submittals with transmittal letter, in duplicate, containing:
13 1. Date
14 2. Project title and number
15 3. Contractor's name, address and telephone number
16 4. The number of each Shop Drawing, Project Datum and Sample submitted
17 5. Other pertinent data
18
19 D. Submittals shall include:
20 1. The date of submission
21 2. The project title and number
22 3. Contract Identification
23 4. The names of:
24 a. Contractor
25 b. Subcontractor
26 c. Supplier
27 d. Manufacturer
28 5. Identification of the product
29 6. Field dimensions, clearly identified as such
30 7. Relation to adjacent or critical features of the work or materials
31 8. Applicable standards, such as ASTM or federal specifications numbers
32 9. Identification of deviations from contract documents
33 10. Suitable blank space for General Contractor and Architect / Engineer stamps
34 11. Contractor's signed and dated Stamp of Approval
35
36 E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
37 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
38 2. Associated items requiring correlation for efficient function or for installation
39

40 3.7 RESUBMISSION REQUIREMENTS 41

- 42 A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a
43 complete submittal as if it were the initial submittal unless otherwise instructed in the review
44 comments on the original submittal.
45 1. Indicate that the document or sample is a resubmittal
46 2. Identify changes made since previous submittals
47
48 B. Indicate any changes which have been made other than those requested by the Architect /
49 Engineer.
50

51 END OF SECTION

SECTION 26 05 16

EXCAVATING, BACKFILLING AND COMPACTING FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.
- B. Refer to Instructions for substitution of materials and products.
- C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

- A. Coordinating all excavating and backfilling for the electrical underground, and all related appurtenances. Provide concrete duct banks as specified in other related Division 26 specification sections.
- B. The extent of raceways, excavation, and backfill shall be in conformance with the locations, raceways, elevations and grades shown on the drawings.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM) Use current edition.
 - 1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
 - 2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
 - 4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- B. Local Authority Having Jurisdiction Standards
- C. Local Governing Agencies or Utilities

1.4 WARRANTY

- A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Concrete: Refer to other Division 26 specification section where concrete encasement is required or specified.
- B. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.

1 C. Sand: Clean, local sand

2
3 D. Earth Backfill: Clean local material consistent with the surrounding earth material and free of
4 large clods, roots, organic materials, rocks or other debris.
5

6 PART 3 – EXECUTION

7
8 3.1 EXCAVATION
9

10 A. General:

- 11 1. All utility trenches shall be constructed in conformance with OSHA trench safety
12 standards.
13 2. Refer to project Geotechnical Report for additional requirements for excavating and
14 backfilling of utility trenches.
15 3. Sheet piling and shoring shall be accomplished to the extent necessary to maintain the
16 sides of the trench in a vertical position throughout the construction period for
17 trenches five feet in depth or deeper. Where approved, trench sides may be laid back
18 in lieu of shoring to meet OSHA safety standards.
19 4. Utilities shall not be constructed or laid in a trench in the presence of water. All
20 water shall be sufficiently removed from the trench prior to the raceway placing
21 operation to ensure a dry, firm bed on which to place the raceway.
22

23 B. Appurtenances:

- 24 1. Any overdepth excavation below appurtenances shall be refilled with cement-
25 stabilized sand.
26

27 C. Electrical Trenches:

- 28 1. Electrical underground raceways must be the minimum depth required by the local
29 governing authority and Power Company.
30 2. Trench width for the electrical raceway shall be a minimum of the outside raceway
31 encasement plus 12 inches.
32 3. Trenches shall be excavated to a depth of at least 6 inches below the conduit
33 raceway. The conduit raceway bedding or concrete encasement shall then be placed
34 in accordance with the specifications, local governing authority, and Power
35 Company standard details.
36

37 3.2 BEDDING AND BACKFILL
38

39 A. Electrical Trenches:

- 40 1. Place backfill, consisting of sand or cement stabilized sand, to a depth of one foot
41 above top of raceway or concrete duct bank and compact to 90% maximum density.
42 2. Backfill the remainder of the trench in 6 inch lifts with select excavated material and
43 compact as required to achieve density of soil of surrounding area.
44

45 B. Utility Locators:

- 46 1. Provide metallic locators for utility company raceways as required by respective
47 utility.
48 2. Refer to other specification sections for additional requirements for underground
49 raceway locators and markers.
50

51 END OF SECTION

SECTION 26 05 19

CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical conductors, wire and connector work as shown, and specified.
- B. Types: The types of conductors and connectors required for the project include the following:
 - 1. 600V building conductors
 - 2. 600V building conductor connectors
- C. Application: The applications for conductors and connectors required on the project are as follows:
 - 1. Power distribution circuitry
 - 2. Lighting branch circuitry
 - 3. Appliance, receptacle, and equipment branch circuitry
 - 4. Motor branch circuitry
 - 5. Control wiring
 - 6. Line voltage
- D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

- A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

- A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – Provide products manufactured in the USA

2.1 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Cable Lubricant: Fire resistant, nonflammable, water-based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.
- C. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
 - 1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
 - 2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
- D. Insulation for standard building conductors: Insulation shall meet or exceed the requirements

CONDUCTORS AND CONNECTORS – 600 VOLT

of UL 83, Standard for Thermoplastic Insulated Wires.

1. All wiring inside lighting fixtures shall be temperature rated per NEC.
2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

- A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT					
System/ Phase	A	B	C	N	G	IG
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:

1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.
- C. Conductors:
1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
 2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
 3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
 4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
 5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
 6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to

- remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
7. Run feeders their entire length in continuous section without joints or splices.
 8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
 9. Provide the same size wire from the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
 10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
 - a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
 - b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.
 - c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
 - d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
 - e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
 - f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
 11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.
 12. Support conductors in vertical raceways, as required by the NEC.
 13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
 14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
 15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
 16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
 17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
 18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
 19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
 20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-

CONDUCTORS AND CONNECTORS – 600 VOLT

- straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
 21. Clean conductor surfaces before installing lugs and connectors.
 22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
 24. Run mains and feeders their entire length in continuous pieces without splices or joints.
 25. Color code conductors.
 26. Do not install a pull string in conduits containing conductors.
 27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
 28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.
- D. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- E. Splices and Joints:
1. In accordance with UL 486A, C, D, E, and NEC.
 2. Aboveground Circuits (No. 10 AWG and smaller):
 - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors.
 - b. The integral insulator shall have a skirt to completely cover the stripped wires.
 - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
 3. Motor connections:
 - a. All AHU motors connections shall be split bolt connectors.
 - b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
 - c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.
- F. Aboveground Circuits (No. 8 AWG and larger):
1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
 3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- G. Underground Branch Circuits and Feeders:
1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.
- 3.2 TESTING
- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.

- 1 B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance
2 conductor and each feeder conductor shall have its insulation resistance tested after the
3 installation is complete except for connection at its source and point of termination. Testing
4 shall be performed by qualified technicians who have been trained in testing procedures and
5 in the use of all test equipment.
6 1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not
7 less than 1000 VDC; measure resistance from conductor to conductor, conductor to
8 neutral (if present) and from conductor to ground. Insulation resistance shall not be
9 less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

- 10 2. Conductors that do not meet or exceed the insulation resistance values listed above
11 shall be removed, replaced, and retested.
12

- 13 C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4
14 copies of certified test results to Architect for review. Test reports shall include conductor
15 tested, date and time of test, relative humidity, temperature, and weather conditions.
16

- 17 D. Voltage and Current Values: The voltage and current in each conductor shall be measured and
18 recorded after connections have been made and the conductor is under load.
19

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT
(Specification Paragraph 3.2, C)

Date _____

Contract and Work Location: _____

Contract (Project) No.: _____

Circuit Identification: _____
(Dwg., Title, Number and Ckt. Number)

Test Equipment: _____
(Make, Model, Serial No., Etc.)

Applied Test Voltage _____

Normal Oper. Voltage _____

Cable Installation: New _____ Used _____
(Date) (No. Years)

Cable Size _____ AWG

Cable Length _____ Ft.

Cable Material _____ Cu _____ Al

Temperature _____ Humidity _____

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION

SECTION 26 05 27

EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Grounding shall conform to the requirements of:
 - 1. National Electrical Code
 - 2. Governing local codes
 - 3. Local Utility Company
- B. Ground effectively and permanently.
 - 1. Verify existing neutral conductor bonding at the main service disconnect and at other new/relocated or reused separately derived systems.
 - 2. All new/relocated conduit or cable tray systems and busway
 - 3. All new/relocated electrical equipment and related current carrying supports or structures
 - 4. All new / relocated metal piping systems
 - 5. All new building structural metal frames

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."
- B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."
- C. Article 250 of the NEC (NFPA 70) for grounding.
- D. NECA – Standard of Installation
- E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copperweld
- B. nVent ERICO
- C. Burndy
- D. O.Z. Gedney
- E. Eaton

2.2 GROUNDING ELECTRODES

- A. Driven Rod Electrode
 - 1. 3/4" x 10'-0" copper clad grounding electrode, UL listed

EXPANSION OF EXISTING ELECTRICAL GROUNDING SYSTEM

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
- 2. UL listed grounding electrode connector
 - 3. Approved thermal fusion methods (exothermic)
 - B. Metal Frame of Building
 - C. Existing grounding electrode system
- 2.3 DRIVEN ELECTRODE ACCESS BOX AND COVER
- A. Hubbell Tier 22 FRP 20-inch round bolt down cover with "GROUND" embossed on top.
- 2.4 MATERIALS AND COMPONENTS
- A. Reference other sections of this specifications for materials specified there.
 - B. Heavy-duty, copper, two bolt type, copper alloy or bronze compression lugs for grounding and bonding applications, in configurations required for particular installation.
- PART 3 - EXECUTION
- 3.1 SYSTEMS 600 VOLTS OR LESS
- A. In the existing service equipment, field verify existing condition of ground bus.
 1. Field verify existing bond of the ground bus to the existing service grounding conductor, to the neutral bar.
 2. Tighten existing ground lugs and connections.
 - B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
 1. In rigid PVC conduit.
 2. Provide thermo fusion connection for each rod ground electrode.
 - a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
 - b. Install rod electrodes as indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
 - c. The minimum distance between driven ground rod electrodes shall be 10'.
 3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and for equipment grounds.
 - a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.
 - b. Refer to drawings for project specific ground resistance requirements.
 - C. Field verify the grounding electrode conductor between the ground bus and the grounding electrode systems are in compliance with the NEC.
 - D. Provide an insulated grounding conductor inside all new conduits, raceways, surface raceways and cables used for power distribution. The ground wire shall be bonded to each box. All bonding jumpers shall be routed inside conduit or raceway.
 - E. Provide an insulated, isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and receptacles.

- F. Provide all new/relocated conduits terminating in switchgear, transformers, switchboards, and panelboards with grounding bushings, where required and ground wire extended to ground bus in equipment.
- G. Where modifications to the main service disconnect are required, main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.
- H. Interface with lightning protection system when lightning protection system is specified.
- I. Locate and install anchors, fasteners, and supports in accordance with NECA "Standard of Installation".
- J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- K. Do not use spring steel clips and clamps.
- L. Do not use powder-actuated anchors.
- M. Do not drill or cut structural members.
- N. Do not use compression or mechanical connectors underground.

3.3 MISCELLANEOUS REQUIREMENTS

- A. Continuity of the building equipment grounding system shall be maintained throughout the project. Grounding jumpers shall be inside conduit, fittings and boxes and shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, light fixture pigtails in excess of 6', and other non-electrically continuous raceway fittings.
- B. Grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable PVC raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.
- C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.
- D. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Provide #6 ground conductor from telephone/voice/CATV/data company demarcation point to building electrical service entrance ground electrode connection and as required by all local utility companies.
 - 1. New MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico Cadweld #B544A028 ground bar with 7/16-inch holes, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the main electrical service disconnect.
 - 2. New IDF Closets Telecommunications Ground Bar (TGB): Provide Erico Cadweld #B542A004 ground bar with 7/16-inch holes, mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel.
 - 3. Provide #2/0 AWG insulated ground conductor between each TMGB and all

- 1 TGBs.
- 2 4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service
- 3 ground bus at main electrical service switch.
- 4 5. Bond each equipment rack with #6 AWG insulated ground conductor to the
- 5 TMGB / TGB.
- 6 6. Route TMGB – TGB ground conductor using the shortest route practical with
- 7 long radius curves.
- 8
- 9 E. Ground new and removed/replaced lighting fixture bodies to the conduit grounding
- 10 system.
- 11
- 12 F. Receptacles: Provide a ground wire bonded to the conduit ground system, except where
- 13 and insulated isolated grounding receptacle is specified.
- 14
- 15 G. Motor Frames: Ground the frame of each motor with a properly sized separate ground
- 16 wire around flexible conduit.
- 17
- 18 H. Provide grounding access well for each driven ground electrode, not located in manholes
- 19 or pull boxes.
- 20 1. Access well top shall be flush with finish paved surfaces.
- 21 2. Ground access wells located in non-paved areas shall be set two-inches above
- 22 surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced
- 23 concrete crown around neck or opening and sloped down away from pull box
- 24 opening.
- 25 3. Provide thermal fusion (exothermic) connectors approved for direct burial.
- 26
- 27 I. Ground all light poles and all exterior metal structures supporting conduit, switchgear, or
- 28 light fixtures.
- 29
- 30 J. Exterior Electrical Equipment Racks:
- 31 1. Provide driven ground electrode for racks mounted remote from building
- 32 structure.
- 33 2. Where mounted on roof, ground to be building structural steel.
- 34
- 35 K. Ground connections to building steel, grounding electrodes and all underground
- 36 connections shall be by thermal fusion (exothermic).
- 37
- 38 L. Transformers: Provide driven ground electrode and building steel electrode at each
- 39 transformer.
- 40
- 41 M. Bond hot water and cold water piping together at each domestic water heater.
- 42
- 43 3.4 COORDINATION
- 44
- 45 A. General: Coordinate installation of grounding connections for equipment with equipment
- 46 installation work.
- 47
- 48 3.5 TESTING
- 49
- 50 A. Ground Resistance Test: Perform a ground resistance test for comparison to future
- 51 inspection and testing data by the Owner. Test shall be performed using a Biddle Megger
- 52 Earth Tester or equivalent test instrument. The test shall not be performed within 48
- 53 hours after the last rainfall.
- 54 1. Inspect and test in accordance with NETA ATS except Section 4
- 55 2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS,
- 56 Section 7.13

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23

- B. The Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.
- C. Two-Point Bonding Measurements: The two-Point Bonding test shall be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 ohms (100 milliohms).
- D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

END OF SECTION

SECTION 26 05 33

CONDUIT SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

- A. National Electrical Code
- B. Local codes and ordinances
- C. UL
- D. ETL

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

A. Raceways:

1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit
2. PVC Coated RGC: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass, United Fiberglass

B. Fittings:

1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Raco, Ipex, International Metal Hose, Lew Electric Fittings Co.
2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

C. Condulets and Conduit Bodies:

1. Appleton, Form 85
2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

D. Steel MC Cable for light fixture whips:

1. AFC
2. Southwire

- 3. General Cable
- 4. Kaf-Tech

2.2 GENERAL

- A. The minimum conduit size shall be 3/4-inch unless indicated otherwise in Divisions 26, 27 or 28.
 - 1. Branch Circuits: Minimum conduit size shall be 3/4-inch.
 - 2. Feeder Circuits: Minimum conduit size shall be 3/4-inches.
 - 3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be 3/4-inches unless noted or indicated otherwise.
 - 4. The minimum conduit size between buildings for technology, voice, data, fire alarm, video, security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.
- B. The minimum conduit size for flexible metallic conduit for tap connections to individual light fixtures shall be 1/2 inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.
- C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.
- D. BX and AC cable shall not be used on this project.
- E. PVC elbows shall not be used on this project.
- F. Intermediate metal conduit (IMC) shall not be used on this project.

2.3 RIGID METAL CONDUIT

- A. UL labeled, Schedule 40:
 - 1. Mild steel pipe, zinc coated inside and out
 - 2. Aluminum Alloy 6063, T-1 temper
 - 3. Threaded ends
 - 4. Insulated bushings
- B. Fittings shall meet the same requirements as rigid metal conduits.
 - 1. UL labeled
 - 2. Threaded fittings

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. UL labeled, standard weight:
 - 1. Cold rolled steel tubing, zinc coated inside and out
 - 2. Aluminum Alloy 6005, 6063. Temper T-1
- B. Fittings shall meet the same requirements as EMT conduits.
 - 1. UL labeled
 - 2. Insulated throat connectors
 - 3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
 - 4. Cast metal fittings are not approved
 - 5. Uni-couple type connectors are not approved
 - 6. Split ring, anti-short bushings are not approved

2.5 RTRC CONDUIT FITTINGS AND CONDUIT BODIES

- 1 A. UL listed
- 2
- 3 B. Standard wall thickness sizes ¼-inch through 4-inch
- 4
- 5 C. Underground medium wall thickness sizes 5 and 6-inch
- 6
- 7 D. Conduit interface joints above grade, gasket joint below grade
- 8
- 9 E. Extra heavy wall for above ground and/or UL Class 1 Division 2 and Class 1 Zone 2
- 10 applications.
- 11

12 2.6 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

13

- 14 A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The
- 15 PVC coating must have been investigated and verified by ETL as providing the primary
- 16 corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations
- 17 must be ETL Listed with PVC as the primary corrosion protection. Hazardous location
- 18 fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are
- 19 to be used. All conduit and fittings must be new, unused material. Applicable UL standards
- 20 may include UL 6 Standard for Safety, Rigid Metal Conduit, and UL514B Standard for
- 21 Safety, Fittings for Conduit and Outlet Boxes.
- 22
- 23 B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek
- 24 ETL SEMKO High Temperature H₂O PVC Coating Adhesion Test Procedure for 200 hours.
- 25 The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to
- 26 signify compliance to the adhesion performance standard.
- 27
- 28 C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
- 29
- 30 D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed
- 31 at every female fitting opening except unions. The inside sleeve diameter shall be matched to
- 32 the outside diameter of the conduit.
- 33
- 34 E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs
- 35 40 mils in thickness to protect the coating from tool damage during installation.
- 36
- 37 F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to
- 38 effectively seal against the elements. The design shall be equipped with a positive placement
- 39 feature to ease and assure proper installation. Certified results confirming seal performance at
- 40 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.
- 41
- 42 G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.
- 43
- 44 H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit
- 45 and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings
- 46 having areas with thin or no coating shall be unacceptable.
- 47
- 48 I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient
- 49 flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-
- 50 1°C).
- 51
- 52 J. All male threads on conduit, elbows and nipples shall be protected by application of a
- 53 urethane coating.
- 54
- 55 K. All female threads on fittings or conduit couplings shall be protected by application of a
- 56 urethane coating.

- L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
 1. Conduit and conduit exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
 2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
 3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
 4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
 - M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.
 - N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel
- 2.7 STEEL FLEXIBLE CONDUIT
- A. Steel flexible metallic conduit:
 1. Zinc coated inside and out
 2. 18-inches minimum length, 24-inches maximum length
 - B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
 1. 18 inches minimum length; 6 feet maximum length
 - C. Liquid tight flexible steel conduit
 1. Type L.A. - Grounded - UL Approved
 2. 18-inches minimum length, 24-inches maximum length
- 2.8 PVC CONDUIT
- A. UL labeled Schedule 40 and Schedule 80
 - B. PVC fittings and solvent welded joints
 - C. Acceptable PVC conduit manufacturer: Ipex, Cantex
- 2.9 CONDULETS AND CONDUIT BODIES
- A. UL Labeled
 - B. Form 85
 - C. PVC Coated: Form 8
 - D. LBC Condulets shall be used for size 2 inch and above.
 - E. LL and LR Condulets shall not be used for 2 inch and above
- 2.10 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

- 1 A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof
- 2 system with unistrut supports and accessories. Conduit supports shall allow for conduit
- 3 expansion and contraction.
- 4
- 5 B. Refer to roofing specifications for additional information. The limitations and restrictions
- 6 contained in any roofing specification shall prevail and supercede these specifications for roof
- 7 mounted supports for conduits and boxes.
- 8
- 9 C. Approved Manufacturer:
- 10 1. Portable Pipe Hangers
- 11 2. Eaton B-Line
- 12 3. Miro Industries, Inc.
- 13

14 2.11 ALUMINUM CONDUIT

- 15
- 16 A. UL Labeled
- 17
- 18 B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel
- 19 fittings.
- 20 1. UL Labeled for use with aluminum conduit.
- 21

22 2.12 STAINLESS STEEL CONDUIT

- 23
- 24 A. UL Labeled
- 25
- 26 B. Rigid Stainless Steel:
- 27 1. Type 304 Stainless Steel
- 28 2. Threaded ends
- 29 3. Insulated Bushings
- 30
- 31 C. EMT:
- 32 1. Type 304 Stainless Steel
- 33 2. Compression Fittings
- 34 3. Insulated Bushings
- 35
- 36 D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
- 37 1. Type 304 Stainless Steel
- 38

39 2.13 EXTERIOR IN-GRADE PULL BOXES

- 40
- 41 A. Enclosures, boxes and covers are required to conform to all test provisions of the most current
- 42 American Association of State Highway and Transportation Officials (AASHTO) standards
- 43 for H-20 loading applications.
- 44 1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized
- 45 materials, rated for deliberate traffic.
- 46 2. Conduit entry knock-outs as required
- 47 3. Bolt down galvanized steel/cast iron covers
- 48 4. Thin wall knocks outs as required
- 49 4. Integral bottom
- 50 5. Box height as required for specified conduit depth and required top elevation.
- 51 6. Concrete design strength of minimum 5,500 PSI at 28-days
- 52 7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-
- 53 inches beyond the enclosures exterior dimension.
- 54 8. Size and volume as required for application.
- 55

56 PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA "Standard of Installation", concealed where possible.
1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
 2. Arrange supports to prevent misalignment during wiring installation.
 3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 4. Do not attach conduit to ceiling support wires.
 5. Arrange conduit to maintain head room and present neat appearance.
 6. Maintain 4-inch clearance between conduit and rooftop surfaces.
 7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
 8. Bring conduit to shoulder of fittings; fasten securely.
 9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
 10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
 11. Ground and bond conduit as required.
 12. Identify conduit as required.
 13. Route all conduits above building slab perpendicular or parallel to building lines.
 14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.
- B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.
- D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.
- E. Provide separate raceway systems for each of the following when specified, indicated or required:
1. 120/208 volt circuits
 2. 277/480 volt circuits
 3. Emergency
 - a. Life safety branch
 - b. Critical branch
 - c. Equipment branch
 4. Voice/Data
 5. Sound reinforcement
 6. Theatrical and Architectural Dimming Controls
 7. MATV/CATV
 8. Security CCTV
 9. Security System
 10. Communications / PA Systems / Sound System Line Input and Speakers
 11. Fire Alarm

12. Lighting and Building Management Control Systems

- F. Unless shown otherwise, do not install conduit in or below concrete building slabs.
- G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.
- H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands at directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.
- I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer's approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.
- J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer's representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer's representative shall certify the installation is in accordance with manufacturer's installation instructions. Submit copies of installation certification prior to cover-up of underground installation.
- K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Provide insulated throat connectors for EMT conduits.
 2. Provide insulated bushing on all rigid conduit terminations.
 3. Provide locknuts inside and outside of all boxes and enclosures.
 4. Provide threaded type plastic bushing at all boxes and enclosures
- L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
 2. Do not support from metal roof deck.
- M. Completely install each conduit run prior to pulling conductors. All boxes are to be accessible after completion of construction.
- N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.
- O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.
- P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
1. Cable Tension:
 - a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
 - b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
 - c. 1000 lbs. per basket grip.
 2. Sidewall pressure: 500 lbs./ft.

3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
 - a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
 - b. Two (2) equivalent 90-degree bends: not more than one hundred feet (100') between pull points.
 - c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.
 - d. Straight pull: not more than two hundred feet (200') between pull points.
 4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
 5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
 6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
 7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
 8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
 9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
 10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.
- Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.
- R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.
- S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.
- T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.
- U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.
- V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions.

Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.

- W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt “wings” are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.
- X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with “Tee” conduit at motor outlet height for flexible conduit.
- Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.
- Z. Where “LB” condulets are used, 2-inches and larger shall be type “LBD”.
- AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.
- BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc. They are not to be used in lieu of conduit runs. They shall not be used for wall or roof penetrations unless they are installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.
- CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.
- DD. “Daisy Chaining” light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.
- EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.
- FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.
- GG. Install minimum size 2-inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

3.2 CONDUITS

CONDUIT SYSTEMS

- 1
2 A. Conduit above grade indoors:
3 1. Concealed Conduits: EMT with set screw fittings
4 2. Exposed conduits:
5 a. Below nine feet AFF where not directly attached and against building walls,
6 ceiling, or structure: Rigid metal conduit or x-wall RTRC.
7 b. Where subject to physical damage: Rigid metal conduit or x-wall RTRC.
8 c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
9 d. Damp Locations: Aluminum rigid conduit or x-wall RTRC.
10 e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid
11 galvanized steel or x-wall RTRC when installed below 18-inches above
12 finished floor.
13
14 B. Conduit installed above grade outdoors:
15 1. Galvanized rigid steel or x-wall RTRC for conduits up utility poles and where
16 subject to physical damage or where located less than four feet above finished floor.
17 2. Aluminum or x-wall RTRC where not subject to physical damage and where located
18 four feet above finished floor.
19
20 C. Conduit where indicated underground:
21 1. PVC Coated Galvanized rigid steel or RTRC conduit elbows and Schedule 80 PVC,
22 RTRC, or PVC coated galvanized steel straight run conduits. PVC conduits for
23 underground branch circuits shall be Schedule 80 or Schedule 40 PVC.
24 a. PVC conduit and fittings shall be used only for straight horizontal runs and
25 for vertical risers at site lighting pole bases. Bending straight sections of
26 PVC conduit to less than 25-foot radius or the use of PVC factory bends is
27 not allowed.
28 b. Change in direction of conduit runs, either vertical or horizontal, shall be
29 with RTRC or PVC coated galvanized steel elbows or long sweep bends of
30 straight PVC conduit sections. Long sweep bends of straight PVC 20-foot
31 sections shall have a minimum radius of curvature of 25 feet and a
32 maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC
33 sections shall be separated by a minimum of 20-feet of straight, linear, PVC
34 sections.
35 c. Provide RTRC or PVC coated rigid galvanized steel conduit elbows and
36 fittings with urethane interior coating at all changes in direction with radius
37 of less than 25-feet and at all vertical runs to 18 inches above finished floor
38 elevation. For interior slab penetrations, provide continuous RTRC or PVC
39 coated rigid galvanized steel conduit and fittings with urethane interior
40 coating from change in direction to 18 inches above finished floor
41 elevation, except where stubbed-up under and inside equipment or
42 switchgear where conduit shall be terminated at minimum two inches above
43 concrete housekeeping pad.
44 d. Elbows for underground electrical service entrance, feeders, transformer
45 primary / secondary, telecommunication, and low voltage conduits shall be
46 RTRC or PVC coated rigid galvanized steel with long radius as follows:
47 1) Up to 1-inch conduit, minimum 12-inch radius.
48 2) 1.5-inch conduit, minimum 18-inch radius.
49 3) 2-inch conduit, minimum 24-inch radius.
50 4) 2.5-inch conduit, minimum 30-inch radius.
51 5) 3-inch conduit, minimum 36-inch radius.
52 6) 3.5 to 6-inch conduit, minimum 48-inch radius.
53 e. Conduit for all floor boxes shall be routed below building slab from floor
54 box to nearest column, wall, or as indicated.
55 f. Conduits shall not be routed horizontally in building slab, grade beams or
56 pavement.

2. Encase all underground conduits in concrete.
 - a. Concrete shall be tinted red throughout with a ratio of 10 pounds of dye per yard of concrete unless prohibited by utility for utility conduits. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications. Where utility does not require but allows concrete encasement of conduits, provide concrete encasement as specified herein.
 - b. Provide minimum 3-inch concrete encasement around conduits.
 - c. Provide conduit spacers for parallel branch/feeder conduits.
 - d. When prior written approval from Owner and Architect to omit concrete encasement of conduits below building slab is given, conduits either specified or approved in writing to be routed under building slab without concrete encasement for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
 - e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
 3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of concrete encasement minimum 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of concrete encasement at 36 inches minimum below finished grade or pavement.
 4. Provide two "caution" plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
 5. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill or concrete.
 6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter 1/4-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
 7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
 8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product minimum strength of 2,500 PSI.
 9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
 10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.
- D. Conduit shown in concrete walls, floor or roof slab:
1. PVC Coated Galvanized Rigid steel.

CONDUIT SYSTEMS

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
- E. Conduits that penetrate concrete slab, or within 100 feet of cooling towers, or at designated corrosive locations.
1. RTRC
 2. PVC coated galvanized rigid steel
- F. Connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
 2. Liquid tight flexible metal conduit for 24-inch maximum length
 3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures for all power routed through roof curb and to the roof mounted equipment and accessories.
- G. Light fixture whips:
1. Accessible ceilings and open structure: 1/2-inch flexible steel conduit or steel MC cable, length not to exceed 6-feet.
 2. Non-accessible ceilings: 1/2-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture's integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
 3. Dedicated insulated ground wire.
 4. Light fixture whips shall not rest on ceiling grid or tile.
 5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit and steel MC cable shall be kept a minimum of 2 inches clear of roof deck.
- H. Conduits at Natatorium or therapeutic pool areas:
1. Underground conduit shall be as specified in this section.
 2. Exterior conduits and boxes within 100 feet of exhaust openings shall be x-wall RTRC or PVC coated galvanized rigid steel or stainless steel.
 3. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms shall be Schedule 80 PVC. Boxes shall be PVC, or 304 Stainless Steel.
 4. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.
- I. Conduits located inside greenhouses and natatorium pump and water treatment rooms:
1. X-wall RTRC
 2. Schedule 80 PVC
 3. PVC coated galvanized rigid steel conduit and fittings.
- J. Conduits in classified hazardous (Classified) locations:
1. Conduit fittings and seals UL listed for the classification
- 3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS
- A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.

the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.

- B. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.
1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
 2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
 3. Provide two conduits for each multi-media outlet box and each outlet box indicated to contain more than four data, audio, or video drops to accessible ceiling plenum.
 4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
 - a. Non-masonry outlet box: Two 1-inch conduits.
 - b. Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
 - c. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.
- C. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling and be turned horizontally with plastic bushing at terminations.
- D. Conduits for Building Entrance Facilities:
1. Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
 2. Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.
 3. Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
 4. Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
 5. Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.

3.6 EXTERIOR IN-GRADE PULL BOXES

- A. Provide pull boxes where specified and as required.
- B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.
- C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or

opening and sloped down away from pull box opening.

3.7 ALUMINUM ALLOY CONDUCTORS

- A. Where aluminum alloy conductors are specified, approved and substituted for copper conductors, provide the required conduit size based on conduit fill using NEC or recognized cable manufacturer's conduit fill tables for aluminum alloy compact conductors.

3.8 IDENTIFICATION

- A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION

SECTION 26 05 35

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

- A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

- A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.
- B. Raceways: Refer to related sections.
- C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.
- D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.
- B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.
- C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.
- D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.
- E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.

ELECTRICAL CONNECTIONS FOR EQUIPMENT

- 1 F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where
2 motors are not provided with conduit boxes, terminate the conduit in a suitable conduit, and
3 make motor connections. Conduit passing through the housing on connected equipment shall
4 pass through a cleanly cut hole protected with an approved grommet. For all AHU or fan
5 motors and all other motors 10 HP and larger, at the motor connection do not use wire nuts.
6 Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection
7 with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor
8 Connection Kit.
9
- 10 G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives,
11 Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers,
12 electrical disconnects, food service / processing equipment, electronics, control panels and
13 Owner furnished equipment:
14 1. Make conduit penetrations only at the bottom flat surface of the equipment and only
15 where permitted by the equipment manufacturer to avoid un-intentional water entry.
16 Coordinate installation of electrical connections for equipment with equipment
17 installation work. Where equipment manufacture does not permit a bottom conduit
18 entry, verify with Owner/Engineer and locate the conduit entry at the side surface as
19 close as possible to the bottom of the enclosure.
20 2. Where conduit originates from an elevation above the conduit entry, provide a "T"
21 conduit below the enclosure's bottom elevation. Provide conduit from the conduit
22 up to the enclosure bottom horizontal surface for electrical connection.
23
- 24 H. Identification: Refer to Electrical General Provisions for identification of electrical power
25 supply conductor terminations with markers approved as to type, color, letter and marker size
26 by the Architect. Fasten markers at each termination point, as close as possible to each
27 connecting point.
28
- 29 I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control
30 provisions shown for equipment and furnishings with the provisions required for the furnished
31 equipment and furnishings. Where the power and control requirements are less than or equal
32 to those specified, modifications to power and control provisions shall be made at no cost as a
33 part of coordination. Where power and control requirements are in excess of those shown,
34 notify the Architect in writing of the requirements.
35
- 36 J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power
37 and control provisions shown with the provisions required for the furnished equipment.
38 Where the power and control requirements are less than or equal to those specified,
39 modifications to power and control provisions shall be made at no cost as a part of
40 coordination. Where power and control requirements are in excess of those shown, notify the
41 Architect in writing of the requirements. Provide lockable disconnect switches for main
42 power, control power, lighting power, etc. as required by the NEC and all local codes. Provide
43 all necessary means of two-way communication for emergency phones.
44
45

END OF SECTION

SECTION 26 05 37

ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS-- Provide products manufactured in the USA

2.1 FABRICATED MATERIALS

- A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.

1. Type of Various Locations:

- a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
- b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
- c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
- d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
- e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
- f. Surface: Type FS or FD box with surface cover.
- g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
- h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
- i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements

2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.

- B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.

- 1
2 C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring
3 boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.
4
5 D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on
6 covers, of type, shape, and size, to suit respective location and installation.
7 1. Type for Various Locations:
8 a. Minimum Size: 4-inch square, 2-1/8-inches deep.
9 b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed
10 and welded, screw covers unless shown or required to have hinged doors.
11 All boxes mounted above ceiling shall have screw covers. Boxes in all other
12 areas with covers larger than 12-inches shall have hinged with screw
13 covers. Knockouts factory stamped or formed in field with a cutting tool to
14 provide a clean symmetrically cut hole.
15 c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with
16 gaskets and corrosion-resistant fasteners
17
18 E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit
19 location and installation. Construct with threaded conduit ends, removable cover, and
20 corrosion-resistant screws.
21
22 F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box
23 knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit
24 use and installation.
25
26 G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover,
27 equal to Rectorseal Metacaulk box guard and cover guard.
28

29 PART 3 - EXECUTION

30 3.1 INSTALLATION OF BOXES AND FITTINGS

- 31
32
33 A. Install electrical boxes and fittings as shown and as required, in compliance with NEC
34 requirements, in accordance with the manufacturer's written instructions, in accordance with
35 industry practices.
36
37 B. Provide recessed device boxes for wall mounted interactive media boards, video displays,
38 televisions, electronic signage and similar installations.
39
40 C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology,
41 data, voice, video, and multi-media outlet boxes at locations other than wall mounted
42 interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet
43 boxes mounted long axis vertically for security, access control, and video surveillance,
44 coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-
45 1/8-inch deep boxes for all other applications. Where indicated differently on plans or where
46 conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster
47 rings shall not be used to increase size. Provide increased box size as required.
48
49 D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted
50 within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted
51 in the same room served. Junction boxes and pull boxes required for areas with inaccessible
52 ceilings shall be located above the nearest accessible ceiling area. All junction box or pull
53 box openings shall be side or bottom accessible. Removal of light fixtures, mechanical
54 equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling
55 for low voltage terminations shall face towards the floor.
56

- 1 E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas
2 where exposed junction or pull boxes can be used.
3
- 4 F. Determine from the drawings and by measurement the location of each outlet. Locate
5 electrical boxes to accommodate millwork, fixtures, marker boards, and other room
6 equipment at no additional cost to the Owner. The outlet locations shall be modified from
7 those shown to accommodate changes in door swing or to clear interferences that arise from
8 construction as well as modifying them to center in rooms. The modifications shall be made
9 with no cost as part of coordination. Check the conditions throughout the job and notify the
10 Architect of discrepancies. Verify modifications before proceeding with installation. Set wall
11 boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush
12 with the finish and install extension rings as required extending boxes to the finished surfaces
13 of special furring or wall finishes. Provide wall box support legs attached to stud to prevent
14 movement of box in wall.
15
- 16 G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on
17 architectural elevations and as required by local codes.
18
- 19 H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and
20 coordinate to clear backsplash and millwork.
21
- 22 I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for
23 installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the
24 public shall not have stamped knockouts.
25
- 26 J. Provide weatherproof boxes for interior and exterior locations exposed to weather or
27 moisture.
28
- 29 K. Provide knockout closures to cap unused knockout holes in boxes.
30
- 31 L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-
32 inch clearance in front of box or conduit body access.
33
- 34 M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or
35 masonry.
36
- 37 N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or
38 piping system.
39
- 40 O. Provide junction and pull boxes for feeders and branch circuits where shown and where
41 required by NEC, regardless of whether or not boxes are shown.
42
- 43 P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of
44 the partition or slab. Notify the Architect in writing where modification or construction is
45 required to maintain the partition or slab fire rating.
46
- 47 Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of
48 304 stainless steel, weatherproof NEMA 4X construction.
49
- 50 R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull
51 boxes located above accessible ceilings or non-finished areas to correspond to the following
52 colors:
53 1. Orange: - 480/277 VAC systems
54 2. Light Blue: - 240 VAC three phase delta systems.
55 3. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
56 4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems

ELECTRICAL BOXES AND FITTINGS

5. Yellow – Building Management and Control System - BMCS
6. White - Security and Surveillance equipment circuits

- S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example “MSB to Panel HA”). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example “LA2” referring to Panel LA sec. 2 is to be listed as “LA”). Label covers for special applications explaining contents (example “Emerg. Gen. Annunciator controls”, “IDF ground”). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example “Not Used Panel LA”. Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.
- T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
- V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.
- X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- AA. Use adjustable steel channel fasteners for hung ceiling outlet box.
- BB. Do not fasten boxes to ceiling support wires.
- CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.
- DD. Use gang box where more than one device is mounted together. Do not use sectional box.
- EE. Use gang box with plaster ring for single device outlets.
- FF. Support outlets flush with suspended ceilings to the building structure.
- GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
- HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.
- II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

- JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.
- KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.
- LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.
- MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
- NN. Bond equipment grounding conductor to all junction and pull boxes.
- OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.
- PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.
- QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.2 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

END OF SECTION

SECTION 26 05 38

ELECTRICAL FLOOR BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical floor box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

- A. Thomas & Betts, Memphis, TN
- B. Hubbell
- C. Wiremold

2.2 CONCEALED SERVICE - FLOOR BOXES

- A. Series 665/667 as manufactured by Thomas & Betts
- B. Shall be electro-galvanized, 14-gauge sheet steel except at ground floors or waterproof membrane floors where they shall be cast iron.
- C. Construction shall be as required by UL 514A.
- D. Carpet frame shall be nylon UL Recognized Component QMFZ2.
- E. Hinged outer cover shall be reinforced with a 5/32" steel plate.
- F. Shall deliver electric power from duplex receptacles installed below the surface of the floor.
- G. Shall deliver telephone or data cable without interference from the electric power delivery
- H. Shall protect delivery of both services by a hinged cover with a retractable opening and foam plastic dust seal
- I. Hinged cover shall accept carpet or tile to match floor covering and be 180 degrees reversible.
- J. Shall accept conduit sizes up to 1-1/4 inches
- K. Box shall be listed by UL
- L. When hinged cover is closed and no services in place, device shall have no obstructions above surface of floor.

2.3 CONCEALED SERVICE, FIRE RATED, POKE-THROUGH SERVICE FITTINGS

- A. Wiremold Evolution Series - 6AT / 8AT

ELECTRICAL FLOOR BOXES AND FITTINGS

- B. Shall be UL classified for use in up to four hour rated concrete floors, and up to three hour rated steel and concrete floors.
- C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign material with a neoprene gasket at base of fitting.
- D. Shall be installed in a single core drilled hole
- E. Shall permit use with "H" cut opening in carpet so carpet can be restored if position is vacated
- F. Shall have interchangeable service fitting accessories including hinged guard and low voltage communication inserts
- G. Service fitting head shall be bronze.
- H. Low voltage channel shall accept one 50 pair, 24 AWG cable through communication raceway.

2.4 SERVICE FITTING HEADS

- A. Shall be brushed aluminum
- B. Shall deliver electrical power from receptacles as designated on the plans
- C. Shall deliver telephone/data through precut bushed opening
- D. Shall be furnished standard with required receptacles
- E. Shall be furnished standard with conduit nipple for direct screw threading into T&B cover assembly
- F. Shall be listed by UL

2.5 FURNITURE FEED POKE-THROUGH DEVICES

- A. Wiremold 4FFATCAL
- B. Shall be UL classified for use in up to four hour rated concrete floors, and up to three hour rated steel and concrete floors.
- C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign material with a neoprene gasket at base of fitting.
- D. Shall be installed in a single core drilled hole
- E. Aluminum finish.

PART 3 - EXECUTION

3.1 GENERAL

- A. Locate position for floor boxes and runs of conduit as shown on the plans, or as required. Coordinate with the Architect for dimensional locations of floor boxes prior to cutting or pouring slab.

1 B. Select appropriate size of floor boxes, poke-through, or multiple services floor boxes for
2 quantity of wiring devices indicated and as recommended by manufacturer.
3

4 3.2 INSTALLATION
5

6 A. Position floor boxes and conduit runs
7

8 B. After concrete pour, pull wires and install devices according to manufacturer's
9 recommendations.

10 C. Activate in accordance with the National Electrical Code.
11

12 D. Coordinate with floor covering contractor to complete installation.
13

14 E. Core drill openings for poke-through service fitting and install in accordance with
15 manufacturer's instructions.
16

17 1. Minimum spacing of 2' on center and not more than one unit per each 65 square feet of
18 floor area in each span; required by Fire Resistance Directory.
19

20 END OF SECTION

SECTION 26 05 40

ELECTRICAL GUTTERS AND WIREWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical gutter work as shown, as specified and as required.
- B. Application: The types of electrical gutters required for the project include the following:
 - 1. Electrical wiring gutters
 - 2. Voice / Data / Video / Communication and signal distribution wireway

1.2 QUALITY ASSURANCE

- A. UL Label: Gutters and wireways shall be UL labeled.

PART 2 - PRODUCTS

2.1 ELECTRICAL GUTTERS AND WIREWAYS

- A. General: Provide hinged electrical gutters and wireways in the types and sizes indicated or required, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards; with features required.
- B. Size: Provide size indicated. Where size is not indicated, construct in accordance with the NEC and other standards. Gutters shall be of manufacturer's standard lengths, without field cutting or field extensions.
- C. Accessories: Provide gutter and wireway accessories where indicated, constructed of same metal and finish as gutters or wireways.
- D. Supports: Provide gutter and wireway supports indicated, conforming to NEC, and as recommended by the manufacturer, and as specified in Section 26 05 33 Conduit Systems.
- E. Materials and Finishes: NEMA 1 gutters and wireways shall have gray powder coat finish over galvanized steel. Gutters and wireways installed outside shall be NEMA 3RX minimum. Gutters or wireways installed within 100-feet of cooling towers, at kitchen or food preparation areas, and natatorium, spa or therapy pool areas shall be of 304 stainless steel NEMA 4X construction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide gutters and wireways only where specified or required. Use of gutters and wireways shall be kept to a minimum.
- B. Finishing: Remove burrs and sharp edges of gutters and wireways wherever they could be injurious to conductor insulation or jacket.
- C. Installation: Install gutters and wireways where shown or required, in accordance with the manufacturer's written instructions, NEC, NECA "Standard of Installation," and with recognized industry practices to ensure that the gutters and wireways comply with the specified requirements. Comply with requirements of NEMA and the NEC pertaining to

ELECTRICAL GUTTERS AND WIREWAYS

1 installation of electrical gutters.

2
3 D. Grounding: Electrically ground gutters and wireways to ensure continuous electrical
4 conductivity. Provide equipment grounding conductor.

5
6 E. Conductors:

- 7 1. Complete gutter and wireway installation before starting the installation of
8 conductors.
9 2. Provide sufficient space to permit access for installing, splicing, and maintaining the
10 conductors.

11
12 F. A maximum of 12 conduits containing branch circuits shall be allowed to be installed in any
13 gutter or wireway.
14

15
END OF SECTION

SECTION 26 05 50

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson
- B. 3M (Minnesota Mining Manufacturing)
- C. Hilti
- D. Specified Technologies, Inc.
- E. Metacaulk

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

FIRESTOPS

26 05 50-1

SECTION 26 08 00

ELECTRICAL COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section outlines commissioning requirements and activities of the Contractor, Owner, CxA and Design Professionals as related to the Division 26 Electrical.
- B. Related Sections:
 - 1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
 - 2. Division 22 – Plumbing
 - 3. Division 23 – Mechanical
 - 4. Division 26 – Electrical
 - 5. Division 27 – Communications
 - 6. Division 28 – Safety and Security

1.2 DEFINITIONS

- A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTRACT INFORMATION

- A. The Owner will contract directly for commissioning services.
 - 1. Commissioning Agent fee will be paid for directly by the Owner.
 - 2. Contractor shall provide coordination with the CxA including but not limited to labor, materials, and testing equipment as required for the CxA as specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment and other items required for Functional Performance Testing includes but not limited to those listed below. Data logging and software required for testing and corrective measures as required by the contract documents shall be provided by the Contractor.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

- A. Ladders and/or lifts and appropriate fall protection as required by Contractor and the CxA.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

- A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 26 specifications, including specific contractor provided or furnished items indicated by this Section, shall be provided by the

ELECTRICAL COMMISSIONING COORDINATION

Contractor.

3.2 SUBMITTALS

A. Electrical:

1. Lighting controls and lighting equipment submittals conforming to the contract documents.

3.3 EQUIPMENT START-UP

A. Notification:

1. Contractor shall provide ten Owner business day notice to CxA, Owner and Design Team of start-up dates. Owner business days are defined as the Owner's Construction and Maintenance Operations department's normally scheduled work days, typically Monday through Friday, excluding Federal, State, Local, and Owner scheduled Holidays.

B. Prior to start-up, Contractor shall:

1. Verify that equipment and systems are complete, accessible, correctly connected and ready for operation. Perform all pre-start inspections and tests as called for in Division 26 and as recommended by the equipment manufacturer.
2. Pre-start requirements of the manufacturer shall include but not limited to the Contractor's completed applicable documentation and completed inspection and check-list.
3. Complete applicable sections of Pre-functional Checklists (PFCs).
4. Coordinate start-up attendance by manufacturer or their authorized representative as required by the specifications and the manufacturer.

C. At start-up, Contractor shall:

1. Supervise the activities of the manufacturer's authorized start-up technician and/or authorized manufacturer's representative.
2. Verify proper voltage, overcurrent protection, phase, phase sequence, and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of contractor personnel familiar with the installation and operation of equipment being commissioned and the equipment manufacturer's personnel in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues and noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action to comply with the Contract Documents and equipment manufacture's installation and operation requirements.

3.4 PRE-FUNCTIONAL CHECKLISTS

- #### A.
- Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx documentation. PFC's will be provided by the CxA. If approved by the Cx as an alternate, contractor may submit alternate versions of the PFC's to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:

1. Electrical.
 - a. Lighting and lighting controls.

3.5 FUNCTIONAL TESTING

A. General:

- 1
 - 2
 - 3
 - 4
 - 5
1. Contractor shall organize and schedule Contractor Team members to execute the functional testing , which will be directed by CxA.
 - a. Lighting and lighting controls.
- END OF SECTION

SECTION 26 09 25

ELECTRICAL CONTACTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by one of the following:
Schneider Electric - Square D
ABB-General Electric
Siemens
Eaton

2.2 CONTACTORS

- A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
 2. Contacts shall be readily replaceable, self-aligning, silver alloy.
 3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
 4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
 5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
 6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.
- B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
 2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
 3. Normally open contactors shall be spring-loaded open and magnetically closed.
 4. Contactors for emergency lighting or power shall be normally closed.
- C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.
- D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.
- E. Enclosure:
1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.
 2. Contactors and control enclosures installed at kitchen and food preparation locations,

ELECTRICAL CONTACTORS

hose down areas, cooling towers, exterior locations, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

- F. Minimum interrupting rating shall be 35KAIC.

PART 3 - EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

- A. Provide electrically held contactors, with line side wiring complete, in accordance with the National Electrical Code and manufacturer's recommendations.
- B. Fuses: Install fuses where coil control power is fed from line side of contactor.
- C. Adjustment: Adjust operating mechanisms for free mechanical movement.
- D. Coordinate contactor control and operation requirements with the Building Management Control System.
- E. Identify each contactor as specified in Section 26 05 00.
- F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

- A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.
- B. Provide mechanically held contactors where control is three-wire, momentary control signal.
- C. Provide electrically held contactors where control is two-wire, constant control signal for open or close.
- D. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.
- E. Provide normally closed contactors for circuits controlled by "emergency power off" or teacher control switches in science classrooms, computer labs, and vocational instructional areas.
- F. Provide control contactors and cabling for bi-level or tri-level LED drivers. Bi / tri level control contactors for exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both "ON" and "HIGH" settings. Bi / tri level controls for interior lighting shall be controlled by occupancy sensors and local control switch.

END OF SECTION

SECTION 26 09 43

LIGHTING CONTROLS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Lighting control system and components:
 - 1. Touch panel controls
 - 2. Lighting management panels
 - 3. Lighting management modules
 - 4. Low voltage wall stations
 - 5. Power interfaces
 - 6. Wired sensors
 - 7. Stand-alone room based architecture. Provide hardware capable of system network architecture without network connectivity or network interface hardware.

1.2 SUMMARY

- A. The lighting control system specified in this section shall provide, sensor-based (both occupancy and daylight), and manual lighting control, and time based control when configured as a networked system.
- B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed). Specific dimmers shall be capable of “dimming lights to off”.
- C. All system devices within a group or controlled area shall be networked together, enabling digital communication between devices.
- D. The system architecture shall be capable of enabling stand-alone groups (areas) of devices. If the system is networked together the groups or areas shall continue to function in a default capacity, even if network connectivity to the greater system is lost.
- E. The system architecture shall facilitate remote operation via a computer connection when the system is networked together.
- F. The system shall not require any centrally hardwired switching equipment.
- G. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.
- H. The term “occupancy sensor” shall be interchangeable with the term “vacancy sensor” as the control hardware shall be the same device, and be capable of either function.

1.3 SUBMITTALS

- A. Specification line-by-line compliance review consisting of a marked-up copy of these specifications with contractor comments. Refer to Submittals specification section for additional instructions.
- B. Product Datasheets (general device descriptions, dimensions, electrical specifications, wiring details, nomenclature)
- C. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)

LIGHTING CONTROLS

- 1
2 D. Other Diagrams – as needed for special operation or interaction with other system(s)
3
4 E. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory
5 start-up and commissioning.
6
7 F. Hardware and Software Operation Manuals
8
9 G. Other operational descriptions as needed
10
11 1.4 PROJECT CLOSEOUT DOCUMENTATION
12
13 A. Provide a factory published manual
14 1. Warranty
15 2. Technical support contact
16 3. Electronic manual on manufacturer's website for free download
17
18 B. Completed Startup/Commissioning Worksheet with Owner's acceptance and date clearly
19 noted.
20
21 1.5 QUALITY ASSURANCE
22
23 A. All steps in sensor manufacturing process shall occur in North America; including population
24 of all electronic components on circuit boards, soldering, programming, wiring, and housing.
25
26 B. All components and the manufacturing facility where product was manufactured must be
27 RoHS compliant.
28
29 C. In high humidity or cold environments, the sensors shall be conformably coated and rated for
30 condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
31
32 D. All applicable products must be UL / CUL Listed or other acceptable national testing
33 organization.
34
35 1.6 PROJECT CONDITIONS
36
37 A. Only install equipment after the following site conditions are maintained:
38 1. Ambient Temperature 14 to 105 degrees F (-10 to 40 degrees C)
39 2. Relative Humidity less than 90% non-condensing
40
41 B. Standard electrical enclosures shall be permanently installed
42
43 C. Equipment shall be protected from dust, debris and moisture
44
45 1.7 WARRANTY
46
47 A. Five (5) year manufacturer's warranty parts replacement beginning upon completion of
48 Factory Start-up and Commissioning date as noted on the Owner accepted Startup /
49 Commissioning Worksheet.
50
51 1.8 MAINTENANCE & SUSTAINABILITY
52
53 A. Provide new parts, upgrades, and/or replacements available for a minimum of 5 years
54 available to the end user
55
56 B. Provide free telephone technical support

- C. Spare Parts: Provide minimum of 1 unit up to 5% of each hardware device product used, whichever is greater.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:

1. Acuity Brands Lighting, Inc. - System: nLight
2. Legrand North America, LLC - System: WattStopper DLM
3. Eaton Corporation, PLC – System: Greengate
4. Current NX Lighting Controls
5. Lutron - Athena

2.2 SYSTEM REQUIREMENTS

- A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network capable backbone for remote or time based system operation.
- B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, UL 924 emergency lighting relays, dimming outputs, manual switch stations, manual dimming stations. Combining one or more of these components into a single device enclosure is be permissible so as to minimize overall device count of system.
- C. System may interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches, refer to Networked LED Luminaire section below.
- D. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
- E. Devices within a lighting control zone shall be connected with low voltage cabling in any order.
- F. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
- G. When Network architecture is implemented, individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- H. Power for devices within a lighting control zone shall come from either resident devices already present for that zone, controls enabled luminaires, or from the network backbone. Standalone “bus power supplies” are not acceptable.
- I. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications may require remote switching and shall be capable of being networked into the system.

- 1 J. Networked systems shall have one or more primary network control “gateway” devices that
2 are capable of accessing and controlling connected system devices and linking into an
3 Ethernet LAN.
- 4
- 5 K. Networked Systems may use a network bridge device to route communication and distribute
6 power to directly connect lighting zones together for purposes of decreasing system wiring
7 requirements.
- 8
- 9 L. Network system communications shall be hard wired. When systems devices are capable of
10 WiFi, they shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n)
11 wireless data network for purposes of eliminating the network bridge devices and all cabling
12 that connects zones to bridge devices. Use of WiFi shall only be enabled with written
13 permission and documentation from the Owner.
- 14
- 15 M. Networked systems shall have a web-based software management program that enables
16 remote system control, status monitoring, and creation of lighting control schedules and
17 profiles.
- 18
- 19 N. Individual lighting zones shall be capable of being segmented into several local channels of
20 occupancy, photocell, and switch functionality for more advanced configurations and
21 sequences of operation.
- 22
- 23 O. Devices located in different lighting zones shall be able to communicate occupancy, photocell
24 (non-dimming), and switch information via either the wired or WiFi backbone.
- 25
- 26 P. Networked systems shall be capable of operating a lighting control zone according to several
27 sequences of operation. System shall be able to change a space’s sequence of operation
28 according to a time schedule so as to enable customized time-of-day, day-of-week, utilization
29 of a space.
- 30
- 31 Q. Operating modes shall be utilized only in manners consistent with local energy codes.
- 32 1. Auto-On / Auto-Off (via occupancy sensors)
- 33 a. Zones with occupancy sensors automatically turn lights on when occupant
34 is detected.
- 35 b. Zones with occupancy and/or photocell sensors turn lights off when
36 vacancy or sufficient daylight is detected.
- 37 c. Pressing a switch will turn lights off. The lights will remain off regardless
38 of occupancy until switch is pressed again, restoring the sensor to
39 Automatic On functionality.
- 40 2. Manual-On / Auto-Off (also called Semi-Automatic)
- 41 a. Pushing a switch will turn lights on.
- 42 b. Zones with occupancy and/or photocell sensors turn lights off when
43 vacancy or sufficient daylight is detected.
- 44 3. Auto On / Predictive Off
- 45 a. Zones with occupancy sensors automatically turn lights on when occupant
46 is detected.
- 47 b. Zones with occupancy and/or photocell sensors turn lights off when
48 vacancy or sufficient daylight is detected.
- 49 c. Pressing the switch will turn the lights off and a short “exit timer” begins.
50 After the timer expires, sensor scans the room to detect whether occupant is
51 still present. If no occupancy is detected, zone returns to auto-on. If
52 occupancy is detected, lights must be turned on via the switch.
- 53 4. Manual-On to Auto-On/Auto-Off
- 54 a. Pushing a switch will turn lights on.
- 55 b. After initial lights on, zones with occupancy and/or photocell sensors turn
56 lights on/off according to occupancy/vacancy and/or daylight conditions.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Occupancy sensors (network capable):

1. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. Only passive infrared (PIR) technology, which detects occupant motion, shall be used to initially turn lights on from an off state, thus preventing false on conditions.
3. Dual technology sensors shall be used. Only where ultrasonic or microphonic technology might create a false occupied state, not allowing the lights to automatically turn off shall PIR only be used. Acceptable dual technology includes PIR/Microphonics technology (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants or PIR/Ultrasonic technology.
4. Sensors shall include one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only) for BAS/BMCS control.
5. Sensors shall be available in multiple lens options which are customized for specific applications.
6. All sensors shall have the ability to detect when it is not receiving valid communication and blink its LED in a pattern to visually indicate of a potential wiring issue
7. Every sensor parameter shall be available and configurable remotely from the software (when networked) and locally via the device push-button.
8. System shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
9. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection. Embedded sensors shall have an optional photocell
10. Ceiling, fixture, recessed, & corner mounted sensors shall be available.
11. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
12. Sensors shall be the following nLight model numbers, with device options as specified:

C. Daylight (photocell and/or dimming) sensors:

1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
5. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
6. Luminaire mounted dimming photocells shall be embedded into luminaire such that only the lens shows on luminaire face.

D. Power (Relay) Packs:

1. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system.

2. Power Packs shall accept 120 or 277 VAC, rated for a minimum 16 Amps for any type of lighting load or motor load rated to 1 HP, provide 0-10 VDC dimming control, be plenum rated, and provide Class 2 power to the system.
 3. Every Power Pack parameter shall be available and configurable remotely from the software (if networked) and locally via the device push-button.
 4. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
 5. When required by local code, Power Pack shall install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
 6. Secondary Packs shall be available that provide up to 5 Amps of switching and can line voltage dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
 7. Secondary Packs shall be available that provide up to 5 Amps of switching and can dim line voltage 120/277 VAC magnetic low voltage transformers.
 8. Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
 9. Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits and control of 0-10 VDC dimming circuit.
 10. Secondary Packs shall be available that control louver/damper motors for skylights.
 11. Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
 12. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.
- E. Relay & Dimming Panels:
1. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
 2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
 3. Panel shall provide one 0-10VDC dimming output paired with each relay.
 4. Panel shall power itself from an integrated 120/277 VAC supply.
 5. Panel shall be capable of operating as either two networked devices or as one.
 6. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
 7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection.
- F. Networked Auxiliary Input / Output (I/O) Devices:
1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
 2. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.
 4. Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
 5. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (toggle the lighting load) or run a local/remote control profile.
 6. Specific I/O devices shall sense state of low voltage outdoor photocells.

7. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
8. Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).

G. Low Voltage Wall Switches & Dimmers:

1. All devices shall provide toggle on/off switch control.
2. Devices color shall match building standard line voltage wiring device color.
3. Devices with mechanical push-buttons shall provide tactile with LED user feedback.
4. Devices with mechanical push-buttons shall be made available with custom button labeling
5. Devices with a single “on” button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.

H. Graphic Wall Station:

1. Minimum 3.5-inch full color touch screen for selecting up to 16 programmable lighting control preset scenes or acting as up to 16 on/off/dim control switches.
2. Color shall match building standard for line voltage switching.
3. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
4. Device shall enable user supplied .jpg screen saver image to be uploaded.
5. Surface mount to single-gang recessed switch box.
6. Micro-USB style connector for local computer connectivity.

I. Scene Controllers:

1. Two, three, four, or eight buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Color shall match building standard for line voltage switching.
3. Devices shall provide LED user feedback.
4. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
5. When networked, the device shall be capable of selecting a lighting profile be run by the system’s upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
6. Device shall have LEDs indicating current selection.

2.4 START-UP & SUPPORT FEATURES

- A. To facilitate start-up, all devices daisy-chained together shall automatically be grouped together into a functional lighting control zone.
- B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide the quantity of sensors required for complete and proper coverage to completely cover the controlled areas. Contractor shall verify room coverage and ceiling heights with manufacturer and provide the quantity and type of occupancy sensors as required. Rooms shall have one hundred (100) percent coverage of small motion detection to completely cover the controlled areas to accommodate all occupancy habits of single or multiple occupants at any

location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components, architectural components, or Owner installed equipment which may cause obstructions to sensor coverage.

- C. Label each controller with 120/277 Volt circuit (i.e. "HD-27) and room graphic name and number. Do not use architectural room name or number on drawings, use room graphic identification only.
- C. Provide ceiling mounted sensors. Wall mounted sensors shall only be used where ceiling mounted sensors are proven by the manufacturer to be impractical.
- D. For ceilings up to 12-feet AFF, control equipment shall be mounted Above ceiling control equipment shall be wall mounted above an accessible ceiling on 24x24-inch fire resistive 0.75-inch thick plywood back board mounted to the wall above the ceiling, directly above the space/area main entry wall switch station, observing good installation practice and shall be consistent throughout the project. Where the ceiling is over 12-feet, the control equipment shall be located in an adjoining ancillary room/area where the ceiling is 12-feet AFF or lower, typically adjacent to the ancillary room/area above ceiling control equipment location.
- E. Control units used for the security or fire systems shall be powered from the emergency power source as indicated on the drawings. Other control units shall be powered from the lighting circuit, which they control.

3.2 INSTALLATION

- A. When using wire for connections other than Cat 5e with RJ-45 connectors, provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements. Low voltage cabling installed above ceiling shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices.
- B. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- C. The installing electrical contractor shall complete, prior to request of factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed, and confirmed operational.
- D. The installing contractor shall, prior to request of factory start up and site commissioning, request an on-site meeting by including the manufacture's local authorized representative, the Owner and the general contractor, to assist in identification of any open ended issues, thereby eliminating potential for delays and system commission interruptions.
- E. Upon confirmation of progress by local factory representative, the installing electrical contractor shall complete the manufacture's start up request form(s), including any field changes from the contract documents.
- F. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning to the manufacturer's representative. Drawing shall include all wire routing, room by room device ID's and locations of all lighting control devices.

- 1
2 G. Install sensors in accordance with manufacturer's written instructions, requirements of NEC,
3 and in accordance with industry practices. Do not install devices until wall construction and
4 wiring is completed.
5
6 H. Install sensors and switches only in electrical boxes that are clean, free from excess building
7 materials, debris, and similar matter.
8
9 I. Install sensors plumb and aligned in the plane of the wall, floor, or ceiling in where they are
10 installed.
11
12 J. Install wall occupancy sensor switches in boxes on the strike side of doors as hung. Install a
13 uniform position so the same direction will open and close the circuit throughout the project.
14 Where more than one switch is in the same location, install switches in a multi-gang box with
15 a single cover plate.
16
17 K. Provide a cover plate for every switch. Fasten all plates outdoors with type 302 Allen Head
18 "tamper-proof" screws.
19
20 L. Refer to Architectural drawing, elevations, etc. for exact location of wall switches where
21 indicated on the Architectural plans. Coordinate location of all wall switches with other
22 specialty items and millwork and avoid conflicts. Coordinate with all trades to avoid conflicts
23 during construction. Mounting heights of all switches shall comply with current Accessibility
24 Standards and local codes.
25
26 M. Unless indicated otherwise, circuit relays/switchpacks ahead of local control switches. Source
27 → relay/switchpack → local toggle switch(s).
28
29 N. Coordinate with BMCS/BAS Contractor for interface of BMCS/BAS System and wiring
30 connections.
31
- 32 3.3 SENSOR TESTING AND ADJUSTMENT
- 33
34 A. At the time of installation the contractor shall test and adjust each sensor for proper detection
35 of motion appropriate to room usage. The contractor shall follow the testing and adjustment
36 procedures as written in the manufacturer's installation instructions for each sensor model.
37
38 B. Prior to testing and adjusting, verify with Owner/Architect the initial settings for each type of
39 area based on its intended function and use.
40
41 C. Verify with Owner all adjustable functions of each type of occupancy sensor prior to
42 installation. Set all adjustable functions of each type of occupancy sensor as directed by Owner.
43 Initial settings unless directed by Owner / Architect:
44 1. Time delay = maximum
45 2. Zero Time Delay = Off
46 3. Auto-On = On (Occupancy) Auto = OFF (Vacancy)
47 4. Manual-On = Off
48 5. Self-Adjust = Off
49 6. Disable Self-Adjust = On
50 7. Energy Saver (Dual Level) = On
51 8. Manual Override = Off
52
53 D. Bi-level occupancy wall switches shall be initially set with the energy saver feature enabled.
54
55 E. Before energizing, check for continuity of circuits, short circuits, and grounding connections.
56 After energizing, check devices to demonstrate proper operation.

1
2 F. Operate each wall switch with circuit energized and verify proper operation.
3

4 3.4 FACTORY COMMISSIONING
5

6 A. Upon completion of the installation, the system shall be commissioned by the manufacturer's
7 factory authorized representative who will verify a complete fully functional system.
8

9 B. The factory commissioning shall include the following services. Programming of all button
10 stations, configuration and of all occupancy sensors and photocells.
11

12 C. Provide written or computer-generated documentation on the commissioning of the system
13 including room by room description including:

- 14 1. Sensor parameters, time delays, sensitivities, and daylighting set points.
15 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
16 3. Load Parameters
17

18 D. The electrical contractor shall provide in writing to the manufacturer, General Contractor,
19 Architect, and the Owner with 21 Owner's business days' written notice of the requested
20 system startup and adjustment date.
21

22 E. The electrical contractor shall provide at least (1) journeyman electrician familiar with the
23 installation of the system dedicated to assisting the factory start-up technician for the entire
24 duration of the commissioning process.
25

26 F. Upon completion of the system commissioning the factory-authorized technician shall
27 provide the proper training to the Owner's personnel on the adjustment and maintenance of
28 the system.
29

30 G. Re-commissioning – After 90 days from certificate of occupancy, re-calibrate all sensor time
31 delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report
32 to the Architect / Owner of re-commissioning activity.
33

34 END OF SECTION
35

SECTION 26 12 17

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Copper-wound three-phase transformer exceeding US Department of Energy 2016 Efficiency Standards, with extremely low no load losses.
 - 1. Transformers shall be designed to an efficiency standard higher than NEMA Premium.
- B. Load Mix: Transformer shall be UL 1561 Listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.2 REFERENCES

- A. FEDERAL REGISTER – US Department of Energy, Office of Energy Efficiency and Renewable Energy. 10 CFR Part 431. Energy Conservation Program for Commercial and Industrial Equipment: Energy Conservation Standards for Distribution Transformers; 2016 Standards
- B. DOE Test Method For Measuring The Energy Consumption Of Distribution Transformers Under Appendix A To Subpart K Of 10 CFR Part 431.
- C. Metering Standards:
 - 1. Computational algorithms per IEEE Std 1459-2000
 - 2. UL 916, UL 61010C-1 CAT III
- D. IEEE-1100 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment
 - 1. IEEE Standard 1100 documents how typical transformers feeding electronic equipment produce substantially higher losses under electronic equipment load compared to under linear load, requiring derating.
- E. LEED – Leadership in Energy and Environmental Design, U.S. Green Building Council.
- F. ISO 9000:2000 – International Standards Organization - Quality Management System
- G. ISO 14000:2004 – International Standards Organization - Environmental Management System
- H. NFPA 70 - National Electrical Code (Latest Edition)
- I. NEMA ST20-2014 - Dry-Type Transformers for General Applications
- J. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment
- K. US Department of Energy, 10 CFR Part 431, 2015. Energy Conservation Program: Energy Conservation Standards for Distribution Transformers; Final Rule.
- L. IEEE C57.110-2008 – IEEE Recommended Practice for establishing transformer capability when feeding non-sinusoidal load currents.

ULTRA HIGH EFFICIENCY K-RATED TRANSFORMERS

M. ISO 17025 – International Standards Organization - General requirements for the competence of testing and calibration laboratories.

N. UL 1561 - Dry-Type General Purpose and Power Transformers.

1.3 SUBMITTALS

A. Submit product data including the following:

1. Copy of ISO 14001:2004 Certification of manufacturing operation.
2. Copy of ISO 9001:2000 Certification of manufacturing operation.
3. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
4. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight
5. Inrush Current (typical 3 cycle recovery)
6. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)
7. Efficiency Data
 - a. No load and full load losses per NEMA ST20
 - b. Linear load Efficiency data @ 1/6 load
 - c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
 - d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
 - e. Efficiency under specified K rating load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
8. Copy of Factory ISO 9001 documentation describing nonlinear load test program
 - a. Meter and CT details including model, accuracy, serial numbers and calibration information.
9. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer
10. 25 year Product Warranty Certificate

B. Description of manufacturer's factory nonlinear load test program.

1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.
2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.
3. The nonlinear load bank shall consist of a phase-neutral loading with a specified K rating load profile, representative of a mix of typical commercial equipment.
4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.
5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.
6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

1.4 SPECIFICATION COMPLIANCE REVIEW

- 1
2 A. Mark up a complete copy of the specification section for the product to indicate a)
3 acknowledgement of the specification requirement (Comply), or b) acknowledgement that the
4 particular specification requirement does not apply to this specific project (Not Applicable)
5 or, c) acknowledgement that the specification requirement cannot be made or that a variance
6 is being submitted for review to the Architect/Engineer/Owner (Does Not Comply,
7 Explanation:) Do not submit an outline form of compliance, submit a complete copy with the
8 product data.
9

10 1.5 DELIVERY, STORAGE AND HANDLING
11

- 12 A. Store and protect products
13
14 B. Store in a warm, dry location with uniform temperature. Cover ventilation openings to keep
15 out dust, water and other foreign material.
16
17 C. Handle transformers using lifting eyes and/or brackets provided for that purpose. Protect
18 against unfavorable external environment such as rain and snow, during handling.
19

20 1.6 WARRANTY
21

- 22 A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product
23 line.
24

25 1.7 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING
26 PLANT
27

- 28 A. Registration to current ISO standard is required.
29
30 B. Independent annual audits are conducted.
31
32 C. Product shall be manufactured in registered facility
33
34 D. ISO 9001:2000 Registered – Quality Management System
35
36 E. ISO 14001:2004 Registered – Environmental Management System
37 1. Transformer manufacturing can produce significant emissions of volatile compounds
38 and significant other waste. To minimize environmental impact, the transformer
39 must be the product of a manufacturing process that has been independently audited to
40 comply with the ISO 14001:2004 Environmental Management System Standard,
41 where strict quality control of raw material sourcing and construction techniques
42 maximize product efficiency and minimize emissions and waste byproducts.
43 2. ISO 14001:2004 ensures that a facility has had an independent environmental impact
44 assessment of raw material sourcing and all manufacturing processes, and has
45 implemented an independent annually audited program that minimizes
46 environmental impact during manufacturing process and includes a strictly
47 monitored continuous improvement program.
48

49 PART 2 - PRODUCTS
50

51 2.1 ACCEPTABLE MANUFACTURERS/PRODUCT
52

- 53 A. Powersmiths E-Saver OPAL
54

- 1 B. Power Quality International (EY e-Rated)
- 2
- 3 C. Mirus - ULLTRA
- 4
- 5 2.2 TRANSFORMER SPECIFICATION
- 6
- 7 A. Minimum UL Listed and Labeled K-Rating: K7
- 8
- 9 B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to
- 10 NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated;
- 11 Transformers 750 kVA and less, 600 volt primary and less, shall be UL Listed and bear the
- 12 label. All terminals, including those for changing taps, must be readily accessible by
- 13 removing a front cover plate. Windings shall be continuous with terminations brazed or
- 14 welded. 10kV BIL.
- 15
- 16 C. Insulation System:
- 17 1. Shall be NOMEX-based with an Epoxy Co-polymer impregnate for lowest
- 18 environmental impact, long term reliability and long life expectancy
- 19 a. Class: 220 degrees C
- 20 b. Impregnate Properties for low emissions during manufacturing, highest
- 21 reliability and life expectancy
- 22 c. Epoxy co-polymer
- 23 d. VOC: less than 1.65 lbs./gal (low emissions during manufacturing)
- 24 e. Water absorption (24hrs @25C): less than 0.05% (superior insulation,
- 25 longer life)
- 26 f. Chemical Resistance: Must have documented excellent performance rating
- 27 by supplier
- 28 g. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress,
- 29 overvoltage tolerance)
- 30 h. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation,
- 31 extending useful life
- 32
- 33 D. Operating Temperature Rise: Maximum 115 degree C in a 40 degree C maximum ambient
- 34
- 35 E. Noise levels:
- 36 1. 3dB Below NEMA ST-20
- 37 2. Production Test every unit. Data to be available upon request.
- 38
- 39 F. Exceed minimum efficiency requirements of US Department of Energy, 10 CFR Part 431,
- 40 April 18, 2013, Energy Conservation Program: Energy Conservation Standards for
- 41 Distribution Transformers: Final Rule which takes effect January 1, 2016, and comply with
- 42 the table of maximum no Load Losses, efficiency requirements at 1/6 load, efficiency at 35%
- 43 load per 10 CFR Part 431, and efficiency at 25% load under the transformer specified K-
- 44 rating load profile.
- 45
- 46 G. Maximum losses and minimum efficiency under linear load conditions per Table 1.
- 47

Table 1 Max and Min Values for Losses and Efficiency for “High Efficiency” Transformers Under K1 Linear and Specified K-Rating Nonlinear Loading				
kVA	No	16.5% Load	25% Load	35% Load

Table 1 Max and Min Values for Losses and Efficiency for “High Efficiency” Transformers Under K1 Linear and Specified K-Rating Nonlinear Loading													
Rating	Load	K1 Linear		Nonlinear		Linear		Nonlinear		K1 Linear		Nonlinear	
		Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)	Max Loss (kW)	Min Eff. (%)
15	0.054	0.066	97.38	0.067	97.36	0.082	97.86	0.085	97.78	0.109	97.97	0.117	97.82
30	0.091	0.112	97.79	0.113	97.77	0.138	98.19	0.144	98.12	0.183	98.29	0.200	98.13
45	0.124	0.152	98.00	0.154	97.97	0.187	98.36	0.197	98.28	0.248	98.45	0.276	98.28
75	0.181	0.221	98.24	0.225	98.22	0.273	98.56	0.288	98.49	0.362	98.64	0.404	98.48
112.5	0.245	0.300	98.41	0.305	98.38	0.370	98.70	0.393	98.62	0.490	98.77	0.555	98.61
150	0.303	0.370	98.53	0.377	98.50	0.457	98.80	0.486	98.72	0.605	98.86	0.688	98.71
225	0.410	0.501	98.67	0.510	98.64	0.619	98.91	0.659	98.84	0.820	98.97	0.937	98.82
300	0.509	0.622	98.76	0.636	98.73	0.769	98.99	0.829	98.91	1.018	99.04	1.194	98.88
500	0.741	0.906	98.91	0.928	98.89	1.119	99.11	1.213	99.04	1.482	99.16	1.754	99.01

- H. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.
- I. Impedance: Between 3.0% and 6.0% unless otherwise noted.
- J. Enclosure type: Ventilated NEMA 2; NEMA 3RX aluminum or stainless steel when located outdoors, or as indicated otherwise
- K. Finish Color: Provide light gray ANSI-61 paint finish for transformers located outdoors. Provide manufacturer’s standard paint finish color indoors.
- L. Transformer Options:
 1. Electrostatic Shield: Each winding is independently single shielded with a full-width copper electrostatic shield
- M. Closed delta 120/240-Volt secondary, 3-phase, 4-wire with center tap neutral winding transformers:
 1. KVA rating indicated shall be for balanced 3-phase loading. Center tap winding shall allow for a maximum nominal 70-percent of three-phase kVA rating for unbalanced single phase neutral connected 120/240-Volt loads. The center tap winding shall be individually rated or constructed at twice the capacity of each of the other delta connected windings. (Example: a 225kVA rated center tap transformer would consist of two 75-kVA windings and one 150-kVA center tap winding).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.
- B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces.
- C. Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.
- D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors.
- E. Check for damage and loose connections.
- F. Set the transformer plumb and level.
- G. Provide Seismic restraints where required.
- H. Coordinate all work in this Section with that in other sections.
- I. Verify all dimensions in the field.
- J. Adjust transformer secondary voltages to provide the required voltage at the loads.

3.2 TESTING

- A. Insulation Tests: Before energizing, check transformer windings for continuity.
- B. Winding Current: During initial no-load energizing, check current in each primary winding.
- C. Tap Settings: Measure and record load current and voltage of transformers while loaded to verify proper transformer tap settings.
- D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.
- E. Performance Validation: To ensure that the products shipped to the job site meet this specification, provide on-site revenue class accurate efficiency and harmonic measurements of transformers once installed and operating at customer's site. Data shall be collected from primary and secondary sides of the transformer simultaneously on a synchronized cycle by cycle basis. The use of two discrete meters that are not synchronized is not acceptable. Sampling shall be of 10% of transformers on the project once installed and operating, as

SECTION 26 19 13

COMBINATION MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Motor controller work as required, scheduled and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

2.2 MOTOR CONTROLLERS

- A. General: Combination motor controllers shall consist of an integrally mounted, thermal magnetic or magnetic only circuit breaker disconnect or fused disconnect switch as specified in Section 26 24 25. Magnetic, full voltage non-reversing (FVNR) or two speed controller as required, in a heavy duty type, dead front enclosure, surface-mounted; size and number of poles as required. Controllers shall be constructed and tested in accordance with NEMA Standards. Refer to Division 23 for Variable Frequency Inverter furnished by Division 23, installed by Division 26. Minimum controller size shall be NEMA Size 1.
- B. Contacts: Magnetic controller contacts shall be silver alloy, and not require any filing, dressing, or cleaning for the life of the controller.
- C. Operating Coils: Operating coils shall be 120V, pressure molded and designed so that accidental exposure to excessive voltage up to 480V will not damage the coil. Design controller so that when a coil fails due to over voltage, the controller shall open, and not freeze in the closed position.
- D. Overload Relays: Controllers shall have manual-reset, trip-free, solid state, overload relays in each phase conductor. Three phase FVNR controllers shall have three overload relays. Single-phase FVNR controllers shall have an overload relay in each ungrounded conductor. Two speed, full-voltage magnetic controllers shall have overload relays for all six ungrounded conductors. Overload relays shall not be field-convertible from manual to automatic reset. Provide reset button located in front cover to reset all overload relays.
- E. LED Pilot Lights: Provide 30.5mm run and stop pilot lights for all motor controllers. Furnish additional pilot lights for motor controllers as shown. Provide FAST and SLOW pilot lights for two-speed controllers. Pilot lights shall be mounted in the controller enclosure cover. Pilot lights shall be operated from an interlock on the motor controllers, and not be wired across the operating coil.
 - Green - Stop
 - Red - Run
 - Yellow - Slow
 - Blue - Fast

COMBINATION MOTOR CONTROLLERS

- 1
2 F. Controls: Controllers shall have 30.5mm HAND-OFF-AUTOMATIC switches. Provide for
3 FAST-SLOW, REMOTE-LOCAL speed selection from HVAC control system for two-speed
4 controllers. Two-speed controllers shall have deceleration relays between fast and slow speeds.
5 Coordinate motor controller controls with the requirements of Division 23. Motor controller
6 controls shall be mounted in the controller enclosure cover. Control switches shall be un-keyed
7 rotary switches.
8
9 G. Control Power: A single phase control power transformer shall be included with each
10 controller for 120V control power. The primary shall be connected to the line side of the motor
11 controller through two fuses; the secondary shall have one leg fused and one leg grounded.
12 Arrange transformer terminals so that wiring to terminals is not located above the transformer.
13
14 H. Auxiliary Contacts: Each controller shall have two normally open and two normally closed
15 nonconvertible auxiliary contact in addition to the number of contacts required for the holding
16 interlock and control wiring. One or more additional auxiliary contacts can be field installed
17 without removing existing wiring, or removing the controller from its enclosure.
18
19 I. Phase Failure Monitors: Provide a 3-phase failure monitor for each motor controller. Monitor
20 on any or all phases, for phase reversal from A-B-C sequence, under/over voltage, and phase
21 failure. Provide adjustable relay for trip range. Provide automatic reset upon restoration of
22 power to all phases. Where solid state overload relays provide this specified requirement,
23 separate phase failure relays may be omitted.
24
25 J. Unit Wiring: Unit shall be completely pre-wired to terminals to eliminate any interior field
26 wiring except for: connection of power supply conductors to switch line side terminals; motor
27 leads to the controller load side terminals; and control conductors to holding coil terminals.
28
29 K. Enclosure:
30 1. Motor Controllers installed in indoor locations shall be NEMA 1 heavy duty
31 enclosures unless shown otherwise.
32 2. Motor Controllers installed at kitchen and food preparation locations, hose down
33 areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA
34 4X, Type 316 stainless steel.
35
36 L. Minimum interrupting rating shall be 35KAIC.
37

38 2.3 MANUAL MOTOR CONTROLLERS 39

- 40 A. General: Manual motor controllers shall consist of an integral controller and overload
41 protection in a common enclosure, surface mounted. Size and number of poles shall be as
42 shown and required with pilot light.
43
44 B. Manual Motor Controller: Manual motor controller with overload protection, 1 HP maximum,
45 115 or 230V.
46
47 C. Enclosures:
48 1. Manual motor controllers installed in indoor locations shall be NEMA 1 heavy duty
49 enclosures unless shown otherwise.
50 2. Manual motor controllers installed at kitchen and food preparation locations, hose
51 down areas, cooling towers, exterior locations, and in other corrosive areas shall be
52 NEMA 4X, Type 316 stainless steel.
53
54 D. Disconnect Switch: For self-protected motors where one pole toggle motor control switch is
55 allowed, the switch shall be horsepower rated and as specified for toggle switches in Section
56 26 27 73.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR CONTROLLERS

- A. General: Install combination motor controllers where required or indicated and in accordance with the manufacturer's written instructions, requirements of the NEC and NECA Standard of Installation, and industry practices. Do not install motor controllers above ceilings. Do not install motor controllers on roofs.
- B. Overloads: Install overload relays with manual reset in each phase of motor controller. Overload adjustable settings shall be based on actual motor nameplate full load amps. Field verify nameplate full load amps and adjust all relay settings accordingly.
 - 1. Set overcurrent at motor service factor x motor nameplate FLA
 - 2. Set high voltage trip to 8.3 percent above nominal voltage
 - 3. Set undercurrent trip to four automatic restarts
 - 4. Set all other trips to zero auto restarts
 - 5. Phase Failure Relay: Adjust phase failure relay to 10 percent over voltage and 10 percent under voltage.
- C. Coordination: Motor controllers shall be provided to coordinate with motors furnished by Division 23. Motor controller controls shall be provided to coordinate with controls specified in Division 23.
- D. Supports: Provide individual and combination motor controllers with galvanized angle or other suitable supports if mounting on wall or other rigid surface is impractical. Controllers shall not be supported by conduit alone. Where motor controllers are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas. Manual motor controllers shall be installed plumb and aligned in the plane of the wall where they are installed.
- E. Identify each motor controller as specified in Section 26 05 00.
- F. Where motor controllers are indicated to be installed as part of a Motor Control Center, refer to the Motor Control Center specification.

3.2 TESTING

- A. Provide the field services of the manufacturer to provide initial programming of all variable functions, start-up and commissioning of each motor controller.
- B. Pre-Energization Check: Check motor controllers for continuous circuits and short circuits.
- C. Post Hook-Up Test: After wire and cable hook-ups, energize motor controller to show it functions as specified.
- D. Provide thermal infrared scan of the combination motor controllers rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

SECTION 26 24 16

PANELBOARDS AND ENCLOSURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

1.3 SUBMITTALS

- A. Indicate:

1. Detailed dimensions.
2. Enclosure material, finish, and NEMA classification type.
3. Location of main circuit breaker.
4. Mounting and trim.
5. Acceptable incoming conductors' size.
6. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, bus material and rating, withstand ratings, lugs, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

2.2 MATERIALS AND COMPONENTS

- A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.
- B. The overcurrent protective device short circuit, coordination and arc flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper.

PANELBOARDS AND ENCLOSURES

Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.

- D. Main circuit breakers and feeder / branch circuit breakers:
1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
 2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
 3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set by rating plug or adjustable dial, I²t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
 4. Provide permanent lock-off device for all fire alarm system branch circuit breakers, for all smoke control fans and equipment, and where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
 5. General requirements:
 - a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
 - b. Two and three pole breakers shall have internal common trips.
 - c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.
 - d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.
 - e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).
 - f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
 - g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.
 - h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).
- E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.
- F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including required connectors.
- G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.

- H. GFCI circuit breakers not available in the required panel AIC rating shall be series rated with the upstream over current protection device to provide the panelboard with required AIC rating. Coordinate series rating requirements with manufacturer. Mark the panel per NEC 110. The marking shall be visible and state the following: "CAUTION-ENGINEERED SERIES COMBINATION SYSTEM RATED XXX AMPERS. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED".
- I. Panelboard Enclosures:
1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner's standard key system; coordinate with Owner.
 2. All NEMA 1 enclosure panelboards shall be hinged "door-in-door" type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not use third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
 3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
 4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
 5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
 6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
 7. Enclosure shall be for recessed or surface mounting as shown or as required.
 8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

- A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.
- B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.
- C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are permanently and mechanically secured.
- D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).

- 1
2 E. Fuses: Install fuses, of the ratings and class shown.
3
4 F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase
5 balance, unless shown otherwise.
6
7 G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a
8 separately derived neutral system shall have the factory installed neutral to ground bonding
9 screws and straps removed and disposed of.
10
11 H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches
12 above accessible ceiling close to panelboard location. Label junction box cover as "not used"
13 and include panel identification.
14 1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box
15 from each panelboard section.
16 2. Where recessed panelboard is located above another building floor, also provide (3)
17 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.
18
19 I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are
20 to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall
21 be connected in a neat and professional manner. Conductors brought in from the top or
22 bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they
23 are to be attached. Each conductor shall be run along the full height of the panel and returned
24 to the circuit breaker or fuse location to allow relocation of the conductor to any position
25 along the bus. Panelboard shall be cleaned of all construction debris prior to substantial
26 completion review. Neutral and grounding conductors shall be installed similar to the phase
27 conductors.
28
29 J. Circuit breakers and conductors installed for SPD devices shall be located on the same side as
30 the SPD to allow the shortest and straightest run of conductors in respect to the location of the
31 SPD device. Route all conductors to the SPD device with straight as possible run, using
32 longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and
33 secure with tie straps wherever possible.
34
35 K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and
36 larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.
37
38 L. Install panels so that breaker number 1 is the top left breaker.
39
40 M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back
41 neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless
42 all other rows are full.
43
44 N. Label breaker mounting space with stick-on number labels.
45
46 O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker
47 above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical
48 and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.
49

50 3.2 TESTING

- 51
52 A. Before energizing, energization, check for continuity of circuits and short circuits.
53
54 B. Provide thermal infrared scan of panelboards under full load as directed and witnessed by
55 Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital
56 video documentation with deficiencies corrected for comparison to future test. Make

1 corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-
2 month prior to closeout, and make corrections prior to close-out.
3

4 END OF SECTION

SECTION 26 24 25

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.
- B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

2.2 ENCLOSED SWITCHES

- A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horsepower served.
- B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Switch Mechanism:
 - 1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
 - 2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.

ENCLOSED SWITCHES

- 1
2 D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is
3 present in the circuit, provide a solid neutral with the safety switch. Where a ground
4 conductor is present in the circuit, provide a separate solid ground with the safety switch.
5
6 E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary
7 contacts for fire alarm system monitoring of the position of the disconnect switch.
8

9 2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION
10

- 11 A. Overcurrent protective devices 1,200 Amps and below:
12 1. Where switch is intended as a building service disconnect provide solid neutral and
13 ground bus and service entrance SE rating.
14 2. Molded case circuit breakers:
15 a. Greater than 800 Amp: Solid state true RMS sensing with adjustable:
16 current, I²t settings, ground fault (where required), instantaneous trip, and
17 short time trip; 80-percent continuous current rating.
18 b. 800 Amp and smaller: Solid state true RMS sensing with fixed current
19 setting by rating plug or dial. Breaker shall have adjustable instantaneous
20 trip function with short time tracking.
21 c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have
22 Energy Reducing Maintenance System switch with local status indicator
23 (ERMS).
24 3. Fusible switches:
25 a. Quick-make, quick-break units utilizing the double-break principle of
26 circuit interrupting to minimize arcing and pitting and shall conform to the
27 ratings shown.
28 b. Individual door over the front, equipped with a voidable interlock that
29 prevents the door from being opened when the switch is in the ON position
30 unless the interlock is purposely defeated by activation of the voiding
31 mechanism. All switches shall have externally operated handles.
32 c. 600 Amps and below equipped for Class J fuses.
33 d. 601 Amps and above shall be equipped for Class R or L fuses.
34 e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp
35 fused switches regardless of fuse size installed shall have Energy Reducing
36 Maintenance System switch with local status indicator (ERMS).
37
38 B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection
39 shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200
40 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall
41 include necessary current sensors, internal wiring, and relays to coordinate opening the
42 monitored faulted circuits.
43 1. Ground fault protection shall be set at minimum setting for both current and time
44 during construction. The manufacturer shall include in the submittal data the
45 minimum setting of the device and the recommended setting for normal building
46 operation.
47 2. The ground fault system shall be factory-tested before shipment as specified:
48 a. The manufacturer shall provide a factory ground fault protection system test
49 for circuit testing and verification of tripping characteristics. The
50 manufacturer shall pass predetermined values of current through the sensors
51 and measure the tripping time for each phase and neutral. The measured
52 time-current relationships shall be compared to the trip-characteristic
53 curves. If the ground fault device trips outside the range of values indicated
54 on the curve, the ground fault device shall be replaced or recalibrated.
55 b. Relays, electrically operated switches, shunt-trip switches, circuit breakers,
56 and similar items shall have proper voltages applied to their circuits and

satisfactory operation demonstrated.

- c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.4 ENCLOSURES

- A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.
- B. Enclosures in exterior locations shall be NEMA 4X stainless steel.
- C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.
- B. Location: Provide safety switches within 50' and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).
- C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.
- D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.
- E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.
- F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: "WARNING" (1/2 Inch Letters). "TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE." (1/4 inch letters).

- 1 G. Provide disconnect switch for electric duct heaters.
- 2
- 3 H. Where disconnect switch is used or indicated as the utility service building disconnect,
- 4 provide main bonding jumper and neutral to ground bond connected to the building's
- 5 grounding system. Do not bond neutral to ground when there is a neutral to ground bond
- 6 upstream from the same derived neutral system serving the disconnect switch.
- 7
- 8 I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire
- 9 alarm system monitoring of the position of the disconnect switch, coordinate with Division
- 10 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system
- 11 to monitor all disconnect switches open/closed position that serve the smoke control system.
- 12 All fire alarm and control wiring directly related to the monitoring of the supply power
- 13 disconnect switches and control of the smoke control fans shall be installed in conduit.
- 14

15 3.2 TESTING

16

- 17 A. General: Before energizing, check for continuity of circuits and short circuits.
- 18
- 19 B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full
- 20 load prior to testing / maintenance and modifications and of the modified and new
- 21 switchboard sections after construction as directed and witnessed by Owner. Make corrections
- 22 as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior
- 23 to closeout, and make corrections prior to closeout. Provide digital video documentation with
- 24 test results for comparison between prior condition and post construction modifications and
- 25 future tests.
- 26

27 END OF SECTION

SECTION 26 24 30

FUSES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Fuse work as shown and scheduled, and as specified.
- B. Types: Fuses required for the project include the following:
 - 1. 250 volt current limiting fuses
 - 2. 600 volt current limiting fuses

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

- A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.
- B. Types:
 - 1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
 - 2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
 - 3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
 - 4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

- A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.
- B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION

FUSES

26 24 30-1

SECTION 26 27 73

LINE VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

- A. UL Label: Wiring devices shall be UL labeled.
- B. NEMA Standard WD1 and WD6.
- C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.
- B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277-Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.
- C. Submit manufacturer's product data sheet for each style of device and plate on the project.
- D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toggle switches, straight blade and twist lock devices, interior cover plates:
1. Leviton
 2. Hubbell
 3. Pass and Seymour
 4. Eaton
- B. Dimming
1. Leviton

2. Lutron

2.2 WIRING DEVICE COLOR

- A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in color where the building standard color is not available. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

2.3 RECEPTACLES

- A. Industrial grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, locking plug-tail or back and side wired with screw type terminals, NEMA indicated, (X=color designation).
1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
 2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
 3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
 4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
 5. 20A, 125V plug load control, split circuit marked for "controlled", tamper resistant: Leviton #TDR20-S1G
 6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX
- B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
 2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.
- C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, locking plug-tail or back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
 2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (orange)
 3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
 4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX
- D. USB 2-port charger / tamper-resistant with 125-Volt receptacles:
1. USB type A/C, 1 type A and 1 type C port, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5833-HGX
 2. USB A, 2 type A ports, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5832-HGX
- E. USB 4-port charger:
1. USB type A+C, 2 type A ports and 2 type C ports. 5.0A 5.0VDC charging. Hubbell #USB4ACX.
 2. USB type A, 4 type A ports. 5.0A 5.0VDC charging. Hubbell #USB4X.

2.4 WALL SWITCHES

- A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
 2. Double pole 120/277V, 20A switch: Leviton #1222-2X
 3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
 4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
 5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
 6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G
- B. Rotary key operated switch (verify manufacturer and keying with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Leviton #1221-KL
 2. Two-pole, 120/277V, 20A key operated, Leviton #1222-2KL.
 3. Three-way, 120/277V, 20A key operated switch: Leviton #1223-3KL
 4. Four-way, 120/277V, 20A key operated switch: Leviton #1224-4KL
 5. Key switches shall be all keyed alike to match the Owner's standard key system. Leviton #WS-35 or as otherwise directed by Owner.

2.5 WALL DIMMERS

- A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
 2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
 3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
 4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
 5. Color change kit as required.

2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

- A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GFBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: DRINKING FOUNTAIN GFCI).

2.7 INTERIOR WALL COVER PLATES AND FASTENERS

- A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).
- B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
1. Provide laser cover plate engraving with black filling for all wiring devices indicating panelboard name, circuit, and voltage.
 2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word "EMERGENCY".
 3. Text orientation shall be upright, readable from left to right when cover plate is installed.

4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream ("EDF" for drinking fountains, "RM RECEPPTS", "HOOD RECEPPTS", "VENDING", "REFRIG", etc.) For other loads, Owner/Architect shall determine name plate wording.

2.8 EXTERIOR COVER PLATES

- A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
 1. Vertical mount receptacle: #CKSUV
 2. Horizontal mount receptacle: #CKMU
 3. Two-gang: #2CKU
 4. 30-60 Amp Devices: #CKLSUV

2.9 CORD REELS AND DROP CORDS

- A. Cord Reels:
 1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
 2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
 3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
 4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
 5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.
- B. Drop cord receptacles:
 1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
 2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
 3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

2.10 FIRST RESPONDER EMERGENCY REMOTE POWER OFF (FREPO) STATION

- A. Knox Company Remote Power Rapid Access 4500 Series Shutdown Station
 1. Recessed mount for public spaces and new construction, surface mount for when mounted to equipment or existing construction.
 2. Single lock keyed for local Fire Department/AHJ, verify configuration and keying with Knox Company.
 3. Red Finish
 4. Tamper alert for integration with building security system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
 - 1. Key switches and keys shall be as specified and also as approved by Owner.
 - 2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.
- B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.
- C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.
- D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.
- E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.
- F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.
- G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.
- H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.
- I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.
- J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.
- K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)
- L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.
- M. Do not share neutral conductor on load side of dimming switches.
- N. Install receptacles with grounding pole down, except in any of the following conditions where the grounding pole shall be installed in the up position: healthcare occupancies, if required by

local AHJ, if required by Owner's construction standards or if directed by Owner or Architect. If installed horizontally, install with neutral pole on top.

- O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- P. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.
- Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.
- R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.
- S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.
- T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

3.2 GROUND FAULT PROTECTION FOR PERSONELL

- A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.
- B. GFCI personal protection locations include but are not limited to the following:
 - 1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.
 - 2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following locations indicated below.
 - 3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
 - a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
 - b. Bathrooms/toilets/restrooms
 - c. Janitors/custodial closets and mop sinks.

- 1 d. Laundry areas
- 2 e. Parking structures, service garages, garages and accessory buildings
- 3 f. Basements, crawl spaces (including 120-Volt lighting)
- 4 g. Within 6-feet of all water sources including sinks, mop-sinks, lavatories,
- 5 bathtubs, shower stalls, faucets, eye wash stations, emergency shower
- 6 stations
- 7 h. Indoor damp and wet locations
- 8 i. Locker rooms
- 9 j. Indoor swimming pools and natatoriums areas and adjacent corridor/hall
- 10 convenience receptacle outlets located within 25-feet of all access doors.
- 11 k. Non-dwelling unit therapeutic tubs/pools/whirlpool areas and adjacent
- 12 corridor/hall convenience receptacle outlets located within 25-feet of all
- 13 access doors.
- 14 l. Receptacles serving dwelling unit kitchen counter tops
- 15 m. Vending machines
- 16 n. Elevators, dumb waiters, escalators, moving sidewalks: receptacles in pits,
- 17 hoist ways, well ways or those mounted on the cars of elevators and dumb
- 18 waiters.
- 19 o. Electric vehicle charging equipment.
- 20 p. All receptacles serving kitchen or food preparation counter tops.
- 21 q. Automotive vacuum machines
- 22 r. Drinking water fountains/coolers and bottle fill stations
- 23 s. Corded high-pressure spray washing machines
- 24 t. Tire inflation machines
- 25 u. Dish washers
- 26 v. Receptacles at end of cord reels or drop cords.
- 27 w. Boat houses, boat hoist, and all pier/dock receptacles and lighting (excludes
- 28 shore power that requires GFPE).
- 29 x. Central plant, mechanical rooms and electrical rooms
- 30 y. Wood, metal, or other material fabrication or vocational training shops.
- 31 z. Receptacles that serve educational science and science prep room counter
- 32 tops.
- 33

34 C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine,

35 refrigerators or other equipment, provide remote GFCI blank face in same room as protected

36 receptacle and at a readily accessible location with standard receptacle outlet behind

37 equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power

38 cord distance from the edge of a sink to the surface of the refrigerator.

39

40 D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height

41 as light switches or ganged with the light switch. Provide GFCI protection for all receptacle

42 outlets located below 42-inches in all infant through 2-year old day care and similar areas

43 designated for occupancy by infant through 2-year old day care occupants so the GFCI device

44 can easily be intentionally tripped or tested and reset.

45

46 E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for

47 utilization equipment as required by the NEC and where indicated on the drawings.

48

49 3.3 FIRST RESPONDER REMOTE EMERGENCY POWER OFF (FREPO) STATION

50

51 A. Provide Knox Company first responder remote emergency power off (FREPO) stations as

52 indicated and/or where required by local AHJ. Mounting locations shall be as directed by the

53 local AHJ and exact locations coordinated with the Architect. FREPOs shall be circuited only

54 to shunt trip or shut-down control circuiting. FREPOs shall be recessed mounted in public

55 locations and in all new construction when attached to building construction. Provide surface

56 mount FREPOs when mounted to equipment or existing construction.

- 1
2 B. Integrate the FREPOs to shut-down the building non-emergency and non-legally required
3 power sources which include the main electrical utility service disconnect circuit breaker(s),
4 other than non-life safety or non-legally required distribution scale UPS equipment, and non-
5 life safety or non-legally required local power generation equipment.
6
7 C. Provide FREPOs for fire pump, life safety, and legally required electrical generation
8 equipment only when required by the AHJ. When required by the AHJ, fire pump, life safety,
9 and legally required power generation and/or stored energy power supply equipment shall
10 each have separate dedicated FREPOs that shut down only their associated power
11 generation/stored energy equipment. FREPOs for emergency, and legally required systems
12 shall have minimal 25-foot physical separation from the building main utility service FREPOs
13 and clearly labeled with the equipment that they will shut down. FREPOs for fire pumps shall
14 have minimal 25-foot physical separation from the any other FREPOs and from the building
15 main utility service disconnect and clearly labeled with the equipment that it will shut down.
16
17 D. Integrate the FREPOs tamper switch with the building security or building management
18 control system (BMCS) as directed by Owner.
19

20 3.4 TESTING
21

- 22 A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.
23
24 B. After energizing, check wiring devices to demonstrate proper operation and receptacles for
25 correct polarization, voltage and phase orientation if intended 3-phase equipment is phase
26 orientation dependent for proper motor rotation or operation.
27
28 C. Test each individual GFCI receptacle and all downstream receptacles protected by an
29 upstream GFCI device with simulated ground fault tester, make corrections as necessary.
30
31 D. Operate each wall switch with circuit energized and verify proper operation.
32
33

END OF SECTION

SECTION 26 43 00

SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION/SCOPE

- A. The Surge Protection Device (SPD) covered under this section includes all service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 4th Edition, applied to the line or load side of the utility feed inside the facility. The unit shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.
- B. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

- A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
 - 1. UL 1449 Fourth Edition
 - 2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - 3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
 - 4. IEEE 1100 Emerald Book.
 - 5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
 - 6. UL 1283 – Electromagnetic Interference Filters

1.3 SUBMITTALS

- A. Submit shop drawings complete with all technical information unit dimensions, detailed installation instructions, maintenance manual, and wiring configuration.
- B. Copies of Manufacturer's catalog data, technical information and specifications on equipment.
- C. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and multi-listed to UL 1449 4th Edition and UL 1283.
- D. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
- E. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.
- F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

SURGE PROTECTION DEVICES

- G. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.

1.4 WARRANTY

- A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure SPDs. Very high exposure unit warranties shall include exposure to temporary over-voltage conditions. Provide a minimum 15-year warranty for all medium exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date of substantial completion against failure. Contractor shall install in compliance with applicable national / local electrical codes and the manufacturer's Installation, Operation and Maintenance Instructions. Contractor shall assist the Owner with manufacturer warranty registration.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURER

- A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
1. Recessed mount panelboard extension with brushed stainless-steel front:
 - a. ACT Communications:471- ###V-050-SS-F-PB flush series.
 - b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
 2. Branch panelboard surface mounted:
 - a. ACT Communications 455 series.
 - b. ABB Current Technology CG3 60 series.
- B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
1. ACT Communications 471 series.
 2. ABB Current Technology CGP3 125 series.
- C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
1. ACT Communications 471 x200 series.
 2. ABB Current Technology TG3 200 series.
- D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 2 SPD:
1. ACT Communications 471 SEL series.
 2. ABB Current Technology SEL3 200 series.

The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load. Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

- A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.
- B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.
- C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449 section 37.6: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

- D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
 1. 14 dB from 10 kHz to 1 MHz.
- E. Each Unit shall provide the following features:
 1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
 2. Field testable while installed.
 3. High performance interconnecting cable.
 4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to the SPD unit.
 5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20Ka
 6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
 7. The unit shall be listed as a Type 2 SPD per UL1449.
 8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units

2.3 POWER CABLES FOR CONNECTION

- A. Power wiring: Conductors between all SPDs and switchgear shall be high performance interconnect system "Low Z Cable" cables with Ultra Low impedance characteristics at 10kHz and above.
- B. Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

- A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection shall be provided and as indicated or recommended by the manufacturer.
- B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.
- C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.
- D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer's recommendations shall prevail over the information given in the plans and specifications.
- E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front. Provide brushed stainless-steel front at kitchens and food processing areas.

3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

- A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
 - 1. Service entrance rated 1,201 Amps and above.
- B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
 - 1. Service entrance rated 801 – 1,200 Amps.
 - 2. Switchboards located outside.
- C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
 - 1. Service entrance rated 401 - 800 Amps.
 - 2. Panelboards above 600 Amps.
 - 3. Motor control centers.

1 4. Non-service entrance switchboards.
2

3 D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where
4 indicated:

5 1. Service entrance rated 400 Amps and below.

6 2. Panelboards 600 Amps and below.
7

8 3.3 TESTING
9

10 A. Factory Trained Representative shall provide start-up to include initial verification of proper
11 installation and initiate factory warranty. The technician will be required to do the following
12 as a minimum:

13 1. Verify overcurrent device rating

14 2. Verify all wiring connections and installation conforms to manufacturer's
15 recommendations.

16 3. Record information for each product installed and include in O&M Manual
17

18 B. A copy of the Factory diagnostic test report and written approval of the installation shall be
19 included with the Electrical Operating and Maintenance Manual. The Contractor shall make
20 all adjustments, changes, corrections, etc. as required by the Factory Trained Representative
21 so that the installation follows the manufacturer's installation and operation instructions
22 without additional charge to the Owner.
23

24 END OF SECTION

SECTION 26 51 13

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Lighting fixture work is as shown, scheduled and specified.
- B. Applications: The applications of lighting fixtures required for the project include the following:
 - 1. General lighting
 - 2. Emergency lighting
 - 3. Outdoor area lighting

1.2 QUALITY ASSURANCE

- A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.
- B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.
- C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

- A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.
- B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.
- C. Submittal data shall include luminaire efficiency parameters.
- D. Submittal data for exterior luminaries shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

- A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific component warranty requirements below.

PART 2 - PRODUCTS

LIGHTING FIXTURES

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.
1. Light fixtures:
 - US LED
 - Extra Light
 - Acuity
 - Hubbell
 - Signify
 - Cooper Lighting Solutions
 - Pinnacle
 - HE Williams
 - GE Current
 - LSI
 2. LED Drivers:
 - Philips
 - Osram Optotronic
 - Eldo LED
 3. Emergency Battery Packs with self-testing drivers/inverters:
 - Bodine
 - Chloride
 - Lithonia
 - Dual Lite
 - IOTA
 4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible:
 - Bodine
 5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
 - Bodine GTD20A

2.2 MATERIALS AND COMPONENTS

- A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.
- B. Fixture Types:
1. General:
 - a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
 - b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
 - c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
 - d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
 - e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
 - f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
 - g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
 - i. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor

- j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
 2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
 3. LED Exit Signs: Provide red lettering. The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
 - a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafeteriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
 4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
 5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.
- C. LED drivers:
1. NEMA 410 compliant for in-rush current.
 2. Starting Temperature: -40° F [-40° C].
 3. Input Voltage: 120 to 480 (±10%) V.
 4. Power Supplies: Class I or II output.
 5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 6. Power Factor (PF): ≥ 0.90.
 7. Total Harmonic Distortion (THD): ≤ 20%.
 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
- D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.
- E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.
- F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
1. Bodine BSL-ST Series for OEM installation
 2. Bodine BSL310-SI Series for field installation
 3. Bodine ELI-S Series for line voltage sine wave inverter field installation
- G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.
- H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load
 2. Compatible with 0-10 Volt dimmer switches
 3. UL 924
 4. Minimum 3-year warranty
 5. Integral or remove test switch.

- I. Emergency Generator / Inverter branch circuit transfer switch:
 1. UL 1008
 2. 20 Amp ballast/driver load
 3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.
- B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.
- C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.
- D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.
- E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner's designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.
- F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafeteriums and kitchens.
- G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.
- H. Install in accordance with manufacturers instructions.
- I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
- J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.
- K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.

- 1 M. Install recessed luminaires to permit removal from below.
- 2
- 3 N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory
- 4 requirements for fire rating.
- 5
- 6 O. Install wall-mounted luminaires at height as directed by Architect.
- 7
- 8 P. Install accessories furnished with each luminary.
- 9
- 10 Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.
- 11
- 12 R. Make wiring connections to branch circuit using building wire with insulation suitable for
- 13 temperature conditions within luminaires.
- 14
- 15 S. Bond products and metal accessories to branch circuit equipment grounding conductor.
- 16
- 17 T. Provide emergency transfer devices for light fixtures powered by generator or inverter
- 18 emergency lighting circuits which are used for normal lighting and to be switched with the
- 19 switched normal lighting circuit in the same room, corridor or area.
- 20
- 21 U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting
- 22 equipment and emergency load control devices (ELC). Where normal light fixture circuit is
- 23 switched or contactor controlled, non-switched battery charging or ELC circuit shall originate
- 24 from same branch circuit breaker as switched lighting circuit.
- 25
- 26 V. Provide emergency powered light fixture in front of all electrical switchgear, including but
- 27 not limited to panelboards, switchboards, motor control centers, low voltage control panels,
- 28 transfer switches, motor controllers and disconnect switches.
- 29
- 30 W. Provide emergency battery operated light fixtures at all transfer switch locations and at all
- 31 central battery emergency lighting inverters.
- 32
- 33 X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures
- 34 shall be circuited through lighting contactors. Lighting contactors shall be controlled by the
- 35 Building Management System. Provide separate lighting contactors for:
- 36 1. Parking Lot Lighting
- 37 2. Building Mounted Lighting
- 38 3. Exterior Signage
- 39
- 40 Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located
- 41 in same room as panelboard serving load.
- 42
- 43 Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum
- 44 board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly
- 45 secure junction box to adjoining studs in wall.
- 46
- 47 AA. Lighting Fixture Supports:
- 48 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of
- 49 the ceiling construction to the structural slab or to structural members within a
- 50 partition, or above a suspended ceiling.
- 51 2. Shall maintain the fixture positions after cleaning and relamping.
- 52 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- 53
- 54 BB. Hardware for surface mounting fixtures to suspended ceilings:
- 55 1. In addition to being secured to any required outlet box, fixtures shall be bolted to a
- 56 grid ceiling system at four points spaced near the corners of each fixture. The bolts

LIGHTING FIXTURES

shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

CC. Lighting Fixture Supports for aluminum canopies:

1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

3.2 TESTING

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

SECTION 27 01 00

COMMUNICATIONS OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element
 - 2. Contractor information
 - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment
 - 5. Warranties (without starting dates)
 - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates)
 - 9. Control operations / equipment wiring diagrams
 - 10. Coordination Drawings
 - 11. Schedule of Speakers, Amplifiers, Sound Equipment, Etc.
 - 12. Schedule of Handsets and other Peripheral Devices, Etc.
 - 13. Schedule of Cable, Jacks, Outlets, Etc.
 - 14. Other required operating and maintenance information that are complete.
 - 15. Cable pathway layout drawings and station map
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the (3) completed manuals in final form to the Architect / Engineer.
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
 - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Three complete manuals shall be delivered to the Owner prior to substantial completion.

COMMUNICATIONS OPERATING AND MAINTENANCE MANUALS

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1".
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11"
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer
 - 2) Maintenance contractor as appropriate
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement
 - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems

- 2) Control and flow diagrams
 - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure
 - 2) Instances that might affect validity of warranties or bonds
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts:
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance curves, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, break-in, routine / normal operating instructions
 - 2) Regulation, control, stopping, shut down and emergency instructions
 - 3) Special operating instructions
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting
 - 3) Disassembly, repair and reassembly
 - 4) Alignment, adjusting and checking
 - 5) Routine service based on operating hours
 - d. Manufacturer's printed operating and maintenance instructions.
 - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - f. Schedule of fuses
 - g. Complete equipment field accessible wiring diagrams
 - h. Each Contractor's coordination drawings
 - i. Other data as required under pertinent sections of the specifications
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
 4. Provide complete information for products specified in Division 27.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.

END OF SECTION

SECTION 27 05 00

COMMUNICATIONS GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.
- B. Applicable provisions of this section apply to all sections of Division 27, Communications.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Authorities Having Jurisdiction (AHJ) - Local
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
 - 5. Building Industry Consulting Services International (BICSI)
 - 6. Code of Federal Regulations - Title 47
 - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
 - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
 - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
 - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
 - 11. International Electro-technical Commission (IEC)
 - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
 - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
 - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
 - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
 - 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
 - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
 - 18. National Electrical Safety Code (NESC)
 - 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
 - 20. Society of Cable Telecommunications Engineers (SCTE)
 - 21. Local Accessibility Standards

COMMUNICATIONS GENERAL PROVISIONS

- 1 22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and*
2 *Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67,*
3 *72, 75 and 95*
4 23. Uniform Building Code (UBC)
5 24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604,*
6 *1651, 1681, 1690, 1778, 1977*
7
8 B. Resolve any code violations discovered in contract documents with the Engineer prior to
9 award of the contract. After Contract award, any correction or additions necessary for
10 compliance with applicable codes shall be made at no additional cost to the Owner.
11
12 C. This Contractor shall be responsible for being aware of and complying with asbestos
13 NESHAP regulations, as well as all other applicable codes, laws and regulations.
14
15 D. Obtain all permits required.
16
17 1.3 SUMMARY
18
19 A. Provide complete and working Communications Systems including equipment, conduit,
20 wiring, material, labor and training as described in this Specification and the Drawings. The
21 Communications Systems Drawings and Specifications are the sole property of the Architect
22 and are not to be duplicated, scanned, loaned or in any way made available to persons not
23 designated as authorized by the Architect. All Communications Systems plans and
24 specifications are to be returned to the Architect following completion of bid.
25
26 1.4 SPACE REQUIREMENTS
27
28 A. Consider space limitations imposed by contiguous work in selection and location of
29 equipment and material. Do not provide equipment or material that is not suitable in this
30 respect.
31
32 1.5 RELATION WITH OTHER TRADES
33
34 A. Carefully study all matters and conditions concerning the project. Submit notification of
35 conflict in ample time to prevent unwarranted changes in any work. Review other Divisions
36 of these specifications to determine their requirements. Extend electrical services and final
37 connections to all items requiring same.
38
39 B. Because of the complicated relationship of this work to the total project, conscientiously study
40 the relation and cooperate as necessary to accomplish the full intent of the documents.
41
42 C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends
43 of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and
44 locate bolts and fittings required to be cast in them.
45
46 D. Locate and size openings required for installation of work specified in this Division in
47 sufficient time to prevent delay in the work.
48
49 E. Refer to other Divisions of the specifications for the scope of required connections to
50 equipment furnished under other Division. Determine from the General Contractor /
51 Construction Manager for the various trades, the Owner, and by direction from the Architect /
52 Engineer, the exact location of all items. The construction trades involved shall furnish all
53 roughing-in drawings and wiring diagrams required for proper installation of the electrical
54 work.
55 1. Make final connections to all communications equipment indicated on the drawings,
56 except as noted.

- 1
2 F. Request all Shop Drawings required in ample time to permit proper installation of all
3 electrical provisions.
4
- 5 G. Extend services as indicated to the various items of equipment furnished by others. Rough-in
6 for the various items and make final connections ready for operation upon placing of the
7 equipment.
8
- 9 1.6 CONCEALED AND EXPOSED WORK
- 10
11 A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or
12 above ceilings. "Exposed" is defined as open to view, in plain sight.
13
- 14 1.7 GUARANTEE
- 15
16 A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of
17 substantial completion of the project. During that period make good any faults or
18 imperfections that may arise due to defects or omissions in material, equipment or
19 workmanship. At the Owner's option, replacement of failed parts or equipment shall be
20 provided.
21
- 22 1.8 MATERIAL AND EQUIPMENT
- 23
24 A. Furnish new and unused materials and equipment meeting the requirements of the paragraph
25 specifying acceptable manufacturers. Where two or more units of the same type or class of
26 equipment are required, provide units of a single manufacturer.
27
- 28 1.9 NOISE AND VIBRATION
- 29
30 A. Select equipment to operate with minimum noise and vibration. If noise or vibration is
31 produced or transmitted to or through the building structure by equipment, piping, ducts or
32 other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify
33 such conditions at no additional cost to the Owner. If the item of equipment is judged to
34 produce objectionable noise or vibration, demonstrate at no additional cost that equipment
35 performs within designated limits on a vibration chart.
36
- 37 1.10 ACCEPTABLE MANUFACTURERS
- 38
39 A. Manufacturers names and catalog number specified under sections of Division 27 are used to
40 establish standards of design, performance, quality and serviceability and not to limit
41 competition. Equipment of similar design, equal to that specified, manufactured by a named
42 manufacturer shall be acceptable on approval. A request for prior approval of equipment not
43 listed must be submitted ten (10) days before proposal due date. Submit complete design and
44 performance data to the Architect. The Architect and Owner issue approvals of acceptable
45 manufacturers as addenda to the Construction Proposal Documents.
46
- 47 1.11 UTILITIES, LOCATIONS AND ELEVATIONS
- 48
49 A. Locations and elevations of the various utilities included within the scope of this work:
50 1. Obtained from utility maps and other substantially reliable sources.
51 2. Are offered separate from the Contract Documents as a general guide only without
52 guarantees to accuracy.
53
- 54 B. Examine the site and verify the location and elevation of all utilities and of their relation to the
55 work. Existing utilities indicated on the site plans are for reference only and shall be field
56 verified by the Contractor with the respective public or private utility.

1.12 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.13 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second
Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television (<i>A.K.A. Main Antenna Television</i>)
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet (<i>Now referred to as TR</i>)
T.O.	Telecommunications Outlet

TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to work stations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.14 QUALITY ASSURANCE:

A. Equipment Standards:

1. System and all components shall be brand new stock from manufacturer.
2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

B. Contractor Qualifications:

At the time of Proposal, the Contractor shall:

1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the

corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

- A. Provide SUBMITTALS according to Division 01 and the following.
- B. Requirements:
 - 1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 - 2. Submit proof that all system components and cables are U.L. Listed.
 - 3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
 - 4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
 - 5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
 - 6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.17 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.18 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The

Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.19 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.20 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.21 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.22 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.23 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2014 dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
 3. Three sets of blue or black-line prints of each contract as-built drawing.
- C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.

2. Remove Engineer's Seal, name, address, and logo from drawings.
3. Mark documents AS-BUILT DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY:
5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
6. Indicate exact location of all underground communications raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all communications equipment in and outside of the building.
11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.24 OPERATING TESTS

- A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.25 WARRANTY

- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.
- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.

1
2 B. Temporary Wiring: Temporary power and lighting for construction purposes shall be
3 provided under Division 26. Installation of temporary power shall be in accordance with NEC
4 Article 305.

5
6 C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be
7 removed at the completion of the Contract.
8

9 1.28 EXTRA MATERIALS

10
11 A. Keys: Provide three (3) sets of all keys for system cabinets.
12

13 PART 2 - PRODUCTS

14
15 2.1 WORK INCLUDED

16
17 A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings
18 shall be provided by the Contractor unless specifically excluded or modified in other portions
19 of this Specification or Addendums.
20

21 PART 3 - EXECUTION

22
23 3.1 INSTALLATION

24
25 A. This project has a critical path, which must be closely followed in order to meet the
26 completion date. The Contractor shall review the proposed schedule at the Award of Contract
27 meeting and be prepared to staff his work force according to the schedule constraints
28 presented at that time.
29

30 B. Aesthetics are an important consideration in this installation. All components shall be
31 installed so as to have aesthetically pleasing results as determined by the Owner and
32 Architect. Actual locations of all visible components shall be coordinated in advance with the
33 Owner and Architect.
34

35 C. Install, make fully operational and test the system as indicated on the Drawings and in the
36 Specifications. Where information is not available the worst-case condition must be assumed
37 to ensure a complete, functional system.
38

39 D. Any interfacing with other systems shall be the Contractor's responsibility under this contract,
40 and the details, both logical and physical, of such interfaces shall be reflected in the
41 Submittals and As-Built drawings.
42

43 E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and
44 Communications System shall be coordinated with the Owner and Architect.
45

46 F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and
47 wire shall be furnished and installed to provide a complete and reliable system. Exact location
48 of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect
49 for approval in advance of any installation. Provide as required and as specified in Division
50 26.
51

52 G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a
53 junction box, to the system devices. Provide as required and as specified in Division 26.
54

55 H. Where required, install conduit, cable and wire parallel and square with building lines,
56 including raised floor areas. Conduit fills shall not exceed 40%.

- 1
2 I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all
3 applicable codes and facilitate observation and testing. Securely hand and/or fasten with
4 appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire
5 system. Units shall be installed parallel and square to building lines.
6
7 J. Quiet and vibration-free operation of all equipment is a requirement of this installation.
8 Properly adjust, repair, balance or replace any equipment producing objectionable (in the
9 judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any
10 building and provide additional brackets and bracing if necessary. Any such additions or
11 changes shall be at no additional cost to the Owner.
12
13 K. Installation shall comply with the CODES AND STANDARDS portion of this Section.
14 Where more than one code or regulation if applicable, the more stringent shall apply.
15
16 L. Where new equipment is replacing old equipment, the Contractor is responsible for removing
17 and disposing of the old equipment and doing whatever repair work is necessary as specified
18 by the Owner / Architect.
19
20 M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to
21 meet code at the completion of work and prior to final testing demonstration to the Owner.
22
23 N. The installation shall be performed in a professional manner.
24
25 O. On a daily basis, clean up and deposit in appropriate containers all debris from work
26 performed under the appropriate specification sections. Stack and organize all parts, tools and
27 equipment when not being used.
28
29 P. Preparation, handling and installation shall be in accordance with the Manufacturer's written
30 instructions and technical data appropriate to the product specified.
31
32 Q. All work shall conform to the National Electrical Contractor's Association "Standard of
33 Installation" for general installation practice.
34
35 R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall
36 be vacuumed and cleaned to remove all debris and grease.
37
38 3.2 COORDINATION WITH OWNER / ARCHITECT
39
40 A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically
41 pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of
42 job progress.
43
44 3.3 CUTTING, PAINTING, AND PATCHING
45
46 A. Structural members shall not be drilled, bored or notched in such a manner that shall impair
47 their structural value. Cutting of holes in structural members, if required, shall be done with
48 core drills and only with the specific approval of the Owner / Architect for each instance.
49
50 B. All walls that require cutting or repair during the installation process shall be returned to their
51 original condition, including the matching of colors and finishes to the satisfaction of the
52 Owner / Architect, and at no additional cost to the Owner.
53

3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 or equal). Hand written tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.

- 1 C. All panels shall be provided with permanently attached engraved lamaroid labels with
2 identifying names and functions. All terminal points shall be appropriately labeled. Labels
3 shall be consistent in form, color, and typeface throughout the system and all must contain the
4 name of the system or subsystem as part of the label textual information. Design, color, font
5 and layout shall be coordinated with, and approved by, the Owner.
6
- 7 D. Identification of Equipment:
8 1. All major equipment shall have a manufacturer's label identifying the manufacturer's
9 address, equipment model and serial numbers, equipment size, and other pertinent
10 data. Take care not to obliterate this nameplate. The legend on all nameplates or tags
11 shall correspond to the identification shown on the Operating Instructions.
12 2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall
13 be permanently secured to each wireway, terminal cabinet, and communications
14 (voice, data, video) cabinet or rack.
15 a. Identifying nameplates shall have 1/2-inch high, engraved letters. For
16 equipment designation and 1/4-inch letters indicating source circuit
17 designation, (ie: "IDF(FCR) XXYY –served from MDF (BCR) XXGG).
18 3. Permanent, waterproof, black markers shall be used to identify each communications
19 grid junction box, clearly indicating the type of system available at that junction box.
20 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying
21 equipment connected to it. Nameplates shall also indicate where pull box is fed from.
22 5. Communication hardware located above accessible ceilings: Provide 1/2-inch high
23 black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below
24 hardware located above ceiling. Identification shall be as short as possible yet
25 identifying device above ceiling, i.e. "A/V-EQ".
26
- 27 E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source
28 from whom the material has been obtained are prohibited for installation in public, tenant, or
29 common areas within the project. Also prohibited are materials or devices that bear evidence
30 that markings or insignias have been removed. Certification, testing (example, Underwriters
31 Laboratories), and approval labels are exceptions to this requirement.
32
- 33 F. Warning Signs: Provide warning signs where there is hazardous exposure associated with
34 access to or operation of communications facilities. Provide text of sufficient size to convey
35 adequate information at each location; mount permanently in an appropriate and effective
36 location. Comply with industry standards for color and design.
37
- 38 G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes,
39 gutters, wireways. Identify with drop/circuit number.
40
- 41 H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape,
42 colored red or orange with suitable warning legend describing buried communications lines.
43 All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches
44 below grade and directly above conduits or ductbanks. Provide magnetic marking tape below
45 all underground conduits.
46
- 47 3.6 CUTTING AND PATCHING
48
- 49 A. General: Comply with the requirements of Division 01 for the cutting and patching of other
50 work to accommodate the installation of electrical work. Except as authorized by the
51 Architect / Engineer, cutting and patching of electrical work to accommodate the installation
52 of other work is not permitted.
53

1 3.7 INSTRUCTION OF OWNER'S PERSONNEL

- 2
- 3 A. Prior to substantial completion, conduct an on-site training program to instruct Owner's
- 4 operating personnel in the operation and maintenance of the communications systems.
- 5 1. Provide the training during regular working day.
- 6 2. The Instructors shall be experienced in their phase of operation and maintenance of
- 7 the electrical systems and with the project.
- 8
- 9 B. Time to be allocated for instructions.
- 10 1. Minimum of 20 hours dedicated instructor time
- 11 2. 4 hour on each of 5 days
- 12 3. Additional instruction time for specific systems as specified in other Sections.
- 13
- 14 C. Before on-site training, submit the program syllabus; proposed time and dates; for review and
- 15 approval, minimum 48 hours prior to proposed training time and date.
- 16 1. One copy to the Owner
- 17 2. One copy to the Architect / Engineer
- 18
- 19 D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their
- 20 attendance at the agreed upon times.
- 21
- 22 E. Use operation and maintenance manuals as the basis of instruction. Review manual with
- 23 personnel in detail. Explain all aspects of operation and maintenance.
- 24
- 25 F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing,
- 26 maintenance, and shut down of each item of equipment.
- 27
- 28 G. Demonstrate equipment functions (both individually and as part of the total integrated
- 29 system).
- 30
- 31 H. Prepare and insert additional data in the operating and maintenance manuals when the need
- 32 for additional data becomes apparent during instructions.
- 33
- 34 I. Submit a report within one week after completion of training. List time and date of each
- 35 demonstration, hours devoted to the demonstration, and a list of people present, with their
- 36 respective signatures.
- 37
- 38 J. At the conclusion of the on-site training program, have the person designated by the Owner
- 39 sign a certificate to certify that he/she has a proper understanding of the system, that the
- 40 demonstrations and instructions have been satisfactorily completed, and the scope and content
- 41 of the operating and maintenance manuals used for the training program are satisfactory.
- 42
- 43 K. Provide a copy of the report and the certificate in an appropriately tabbed section of each
- 44 Operating and Maintenance Manual.
- 45

46 3.8 OPENINGS

- 47
- 48 A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other
- 49 divisions. Drawings and layout work for exact size and location of all openings are included
- 50 under this division.
- 51

52 3.9 OBSTRUCTIONS

- 53
- 54 A. The drawings indicate certain information pertaining to surface and subsurface obstructions,
- 55 which has been taken from available drawings. Such information is not guaranteed, however,
- 56 as to accuracy of location or complete information.

1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.
- 3.10 VANDAL RESISTANT DEVICES
- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.
- 3.11 PROTECTION
- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- 3.12 EQUIPMENT BACKBOARDS
- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each communications location.
- 3.13 SITE MANAGEMENT RESPONSIBILITY
- A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF WORK portion of this Section.
- 3.14 START-UP RESPONSIBILITY
- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

- 1 B. Properly ground each piece of electronic equipment prior to applying power. Properly ground
2 all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote
3 or device end.
4
- 5 C. Use a start-up sequence that incrementally brings each portion of the system on-line in a
6 logical order that incorporates checking individual elements before proceeding to subsequent
7 elements until the entire system is operational. The basic steps should include:
8 1. Establish ground planes at the equipment rooms and hub end of the systems as
9 specified in Division 26.
10 2. Disconnect power, connect the first device, reconnect power, and verify operational
11 correctness. Repeat until the entire system is verified and operational.
12
- 13 3.15 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)
14
- 15 A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and
16 properly labeled and identified.
17
- 18 B. All materials shall be neat, clean and unmarred, and parts securely attached.
19
- 20 C. All extra material as specified shall be delivered and stored at the premises as directed.
21
- 22 D. Test reports of each system and each system's components and As-Built Project Drawings
23 shall be complete and available for inspection and delivery as directed by the Owner.
24
- 25 3.16 SYSTEM ACCEPTANCE REQUIREMENTS
26
- 27 A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the
28 following in the order stated.
29
- 30 B. The Contractor shall deliver three (3) composite "System Operations and Maintenance"
31 manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each
32 manual shall contain in appropriately tabbed sections:
33 1. A statement of Guarantee including date of termination and the name and phone
34 number of the persons to be called in the event of equipment failure.
35 2. A set of Operating procedures for the overall System that includes all required
36 Owner activities, and that allows for the Owner operation of all attributes and
37 facilities of the System.
38 3. A section for each specific type of equipment containing the vendor manuals,
39 instruction sheets, and any related literature that came in the original shipping
40 container for that piece of equipment. Include all warranty cards.
41
- 42 C. Testing:
43 1. The Contractor shall perform all tests required by Division 26 and those submitted as
44 part of this Section.
45 2. The Contractor shall activate all devices for proper system operation, including
46 supervisory and trouble circuit tests. Similarly, audible alarms will not be activated
47 except on a one-time, coordinated basis, to check the actual sounding devices.
48 3. A test report for each piece of equipment shall be prepared by the Contractor and
49 submitted to the Owner. This report shall include a complete listing of every device,
50 the date it was tested, by whom and the results. The final test reports shall indicate
51 that every device tested successfully. Failure to completely test and document the
52 tests will result in a delay of final testing and acceptance.
53
- 54 D. As-Built Drawings:

1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
 2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
 2. System Test Reports
 3. As-Built Drawings

3.17 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 27 05 05

COMMUNICATIONS ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that there are existing conditions and devices which are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to take these existing conditions into consideration when making and presenting a proposal to as to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54

- D. Verify that abandoned wiring and equipment serve only abandoned facilities.
- E. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect before disturbing existing installation.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- C. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- D. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- E. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- F. Clean and repair existing materials and equipment that remain or are to be reused.

3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Architect and Owner.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Remove and replace existing conduit, wiring, outlets, devices, and appurtenances as occasioned by new or remodeled construction. Re-establish service to devices that may be interrupted by remodeled construction.
- D. Disconnect communication systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
 - 1. Remove exposed conduit that has been abandoned.
 - 2. Cap conduit beyond the finish line.
- E. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner.
- F. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

- 1 G. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service.
2 Disable system only to make switchovers and connections. Notify the Owner at least 24
3 hours before partially or completely disabling system. Minimize outage duration.
4
- 5 H. Existing Data Network: Maintain existing system in service. Disable system only to
6 make switchovers and connections. Notify the Owner at least 24 hours before partially or
7 completely disabling system. Minimize outage duration.
8
- 9 I. Existing Video Distribution System: Maintain existing system in service. Disable
10 system only to make switchovers and connections. Notify the Owner at least 24 hours
11 before partially or completely disabling system. Minimize outage duration.
12
- 13 3.4 DEMOLITION AND EXTENSION OF EXISTING COMMUNICATION WORK
14
- 15 A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated
16 on the drawings or required by the installation of new facilities. All removals and/or
17 dismantling shall be conducted in a manner as to produce maximum salvage. Salvage
18 materials shall remain the property of the Owner, and shall be delivered to such
19 destination as directed by the Owner's representative unless they are not wanted, then it
20 will be the responsibility of this Contractor to remove such items and properly dispose of
21 them. Materials and/or items scheduled for relocation and which are damaged during
22 dismantling or reassembly operations shall be repaired and restored to good operative
23 condition. The Contractor may, at his discretion, and upon approval of the Owner's
24 representative substitute new materials and/or items of like design and quality in lieu of
25 materials and/or items to be relocated.
26
- 27 B. All items to be relocated shall be carefully removed in reverse to original assembly or
28 placement and protected until relocated. The Contractor shall clean and repair and
29 provide all new materials, fittings, and appurtenances required to complete the
30 relocations and to restore them to good operative order. All relocations shall be
31 performed by workmen skilled in the work and in accordance with standard practice of
32 the trades involved.
33
- 34 C. When items scheduled for relocation and/or reuse are found to be in damaged condition
35 before work has been started on dismantling, the Contractor shall call the attention of the
36 Owner's representative to such items and receive further instructions before removal.
37 Items damaged in repositioning operations are the contractor's responsibility and shall be
38 repaired or replaced by the contractor as approved by the owner's representative, at no
39 additional cost to the Owner.
40
- 41 D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to
42 points indicated on the drawings, specified, or acceptable to the Owner's representative.
43 Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse
44 is to be continued or service is to remain. Such services shall be sealed, capped, or
45 otherwise tied-off or disconnected in a safe manner acceptable to the Construction
46 Inspector. All disconnections or connections into the existing facilities shall be done in
47 such a manner as to result in minimum interruption of services to adjacent occupied
48 areas. Services to existing areas or facilities that must remain in operation during the
49 construction period shall not be interrupted without prior specific approval of the
50 Owner's representative hereinbefore specified.
51
- 52 E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit
53 servicing them is abandoned and removed. Provide blank cover for abandoned outlets
54 that are not removed.
55

- F. Disconnect and remove communication devices and equipment serving utilization equipment that has been removed.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing communication installations that remain active. Modify installation or provide access panel as appropriate.
- I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- D. Repairs, equipment replacements, and corrections to special systems due to damage caused by contractor:
 - 1. For each special system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
 - 2. Corrective measures to the special systems to correct components of the special systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect prior to acceptance of substantial completion at no additional cost to the Owner.

3.6 TESTING AND CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Pre-construction testing of existing low voltage systems:
 - 1. Provide a complete operational test of the following systems prior to demolition and renovation. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be preformed by a contractor and technicians, each certified by the respective manufacturer of the existing special system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
 - a. Paging System.
 - b. Telephone System
 - c. Data Network Communications System
 - d. Video Distribution System
 - 2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and individuals performing the tests. Provide the written report within 14 days of notice to proceed and prior to any demolition or renovation work.

SECTION 27 05 07

COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 01 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
 - 1. Actual technology equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components and openings, doors and obstructions
 - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of communications station devices, telephone outlets and other work specified

in this Division.

1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
1. Field measurements
 2. Field construction criteria
 3. Manufacturer's catalog numbers
 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

- 1 F. Contractor's responsibility for errors and omissions in submittals is not relieved whether
2 Architect / Engineer reviews submittals or not.
3
- 4 G. Contractor's responsibility for deviations in submittals from requirements of Contract
5 Documents is not relieved whether Architect / Engineer reviews submittals or not, unless
6 Architect / Engineer gives written acceptance of the specific deviations on reviewed
7 documents.
8
- 9 H. Submittals shall show sufficient data to indicate complete compliance with Contract
10 Documents:
11 1. Proper sizes and capacities
12 2. That the item will fit in the available space in a manner that will allow proper service
13 3. Construction methods, materials and finishes
14
- 15 I. Schedule submissions at least 15 days before date reviewed submittals will be needed.
16
- 17 1.7 SUBMISSION REQUIREMENTS
18
- 19 A. Make submittals promptly in accordance with approved schedule, and in such sequence as to
20 cause no delay in the Project or in the work of any other Contractor.
21
- 22 B. Number of submittals required:
23 1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
24 2. Product Data: Submit the number of copies the contractor requires, plus those to be
25 retained by the Architect / Engineer.
26
- 27 C. Accompany submittals with transmittal letter, in duplicate, containing:
28 1. Date
29 2. Project title and number
30 3. Contractor's name, address and telephone number
31 4. The number of each Shop Drawing, Project Datum and Sample submitted
32 5. Other pertinent data
33
- 34 D. Submittals shall include:
35 1. The date of submission
36 2. The project title and number
37 3. Contract Identification
38 4. The names of:
39 a. Contractor
40 b. Subcontractor
41 c. Supplier
42 d. Manufacturer
43 5. Identification of the product
44 6. Field dimensions, clearly identified as such
45 7. Relation to adjacent or critical features of the work or materials
46 8. Applicable standards, such as ASTM or federal specifications numbers
47 9. Identification of deviations from contract documents
48 10. Suitable blank space for General Contractor and Architect / Engineer stamps
49 11. Contractor's signed and dated Stamp of Approval
50
- 51 E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
52 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
53 2. Associated items requiring correlation for efficient function or for installation
54
- 55 1.8 SUBMITTAL SPECIFICATION INFORMATION
56

- 1 A. Every submittal document shall bear the following information as used in the project manual:
- 2 1. The related specification section number
- 3 2. The exact specification section title
- 4
- 5 B. Submittals delivered to the Architect / Engineer without the specified information will not be
- 6 processed. The Contractor shall bear the risk of all delays, as if no submittal had been
- 7 delivered.
- 8

9 1.9 RESUBMISSION REQUIREMENTS

10

- 11 A. Make resubmittals under procedures specified for initial submittals.
- 12 1. Indicate that the document or sample is a resubmittal
- 13 2. Identify changes made since previous submittals
- 14
- 15 B. Indicate any changes which have been made other than those requested by the Architect /
- 16 Engineer.
- 17

18 1.10 CONTRACTOR'S STAMP OF APPROVAL

19

- 20 A. Contractor shall stamp and sign each document certifying to the review of products, field
- 21 measurements and field construction criteria, and coordination of the information within the
- 22 submittal with requirements of the work and of Contract Documents.
- 23
- 24 B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner
- 25 and Architect / Engineer that Contractor has either determined and verified all quantities,
- 26 dimensions, field construction criteria, materials, catalog numbers, and similar data or
- 27 assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each
- 28 submittal with the requirements of the work and the Contract Documents.
- 29
- 30 C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's
- 31 stamp of approval and signature.
- 32
- 33 D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and
- 34 signature will not be processed. The Contractor shall bear the risk of all delays, as if no
- 35 submittal had been delivered.
- 36

37 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

38

- 39 A. The Architect / Engineer will:
- 40 1. Review identified submittals with reasonable promptness and in accordance with
- 41 schedule. Specific equipment submittals that may be required to be expedited shall
- 42 be submitted separately without other submittal items not requiring the same prompt
- 43 attention.
- 44 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or
- 45 approval of submittal
- 46 3. Return submittals to Contractor for distribution or for resubmission
- 47
- 48 B. Review of submittals will not extend to design data reflected in submittals that is peculiarly
- 49 within the special expertise of the Contractor or any party dealing directly with the
- 50 Contractor.
- 51
- 52 C. Architect / Engineer's review is only for conformance with the design concept of the project
- 53 and for compliance with the information given in the contract.
- 54 1. The review shall not extend to means, methods, sequences, techniques or procedures
- 55 of construction or to safety precautions or programs incident thereto.
- 56 2. The review shall not extend to review of quantities, dimensions, weights or gauges,

1 fabrication processes or coordination with the work of other trades.
2
3 D. The review and approval of a separate item as such will not indicate approval of the assembly
4 in which the item functions.
5
6 1.12 SUBSTITUTIONS
7
8 A. Do not make requests for substitution employing the procedures of this Section.
9
10 B. The procedure for making a formal request for substitution is specified in Division 1.
11
12 PART 2 - PRODUCTS - NOT USED
13
14 PART 3 - EXECUTION
15
16 3.1 SHOP DRAWINGS AND PRODUCT DATA
17
18 A. Submittals shall not be combined or bound together with any other material submittal.
19
20 B. Submit individually bound shop drawings and product data for the following when specified
21 or provided:
22 1. Structural Cabling
23 2. Communications System
24 3. Sound Reinforcement System
25 4. CATV System
26
27 3.2 COORDINATION DRAWINGS
28
29 A. Submit coordination drawings as specified.
30
31 END OF SECTION

SECTION 27 05 09

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

CONTRACT QUALITY CONTROL

1 1.7 MOCK UPS

- 2
- 3 A. Assemble and erect the specified equipment and products complete, with specified anchorage
- 4 and support devices, seals and finishes.
- 5
- 6 B. Do not proceed with any work involving a mock-up, until the related mock up has been
- 7 approved in writing.
- 8
- 9 C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- 10
- 11 D. Perform tests and submit results as specified.
- 12

13 1.8 SCHEDULING OF MOCK-UPS

- 14
- 15 A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
- 16 1. Rough-in
- 17 2. Finish with all appurtenances in place
- 18 3. Demonstrations
- 19

20 PART 2 - PRODUCTS

21

22 2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

23

24 PART 3 - EXECUTION

25

26 3.1 ADJUSTMENTS AND MODIFICATIONS

27

- 28 A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's
- 29 qualified personnel at no additional cost to Owner.
- 30

31 3.2 MOCK-UPS

32

- 33 A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring
- 34 devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring
- 35 devices to above ceiling space to demonstrate conduit routing and conductor fill.
- 36

37 END OF SECTION

SECTION 27 10 00

DATA COMMUNICATIONS STRUCTURED CABLING

PART 1 – GENERAL

1.1 SUMMARY OF WORK

- A. Furnish and install horizontal cabling inclusive of Category 6 cabling, jacks, faceplates, patch cords, above-ceiling supports, labels, testing and all supporting equipment to provide a complete and fully functional solution as described in this specification.
- B. Furnish and install backbone cabling inclusive of fiber, multi-pair copper, connectors, bulkheads, patch cords, above-ceiling supports, testing, and all supporting equipment to provide a complete and fully functional solution as described in this specification.
- C. Furnish and install head-end equipment inclusive of 2-post racks, patch panels, fiber termination boxes, wire managers, ladder rack, fire-rated plywood, power-strips, grounding and all supporting equipment to provide a complete and fully functional solution as described in this specification.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. The structured cabling contractor shall be licensed and shall meet all applicable regulations.
 - 2. The contractor shall be certified by the manufacturing company in all aspects of design, installation, and testing of the products described herein and must be authorized to provide warranty.
 - 3. The manufacturer shall have, at the district's disposal, a certified employee or support phone number that can be reached during normal operating hours for product support and service.
 - 4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and metallic premise distribution systems and shall have personnel who are adequately trained in the use of such tools and equipment. Contractor shall provide evidence of minimum five (5) years' experience on similar structured cabling systems.
 - 5. A resume of qualifications shall be submitted with the contractor's proposal indicating the following:
 - a. A list of five (5) recently completed projects of similar type and size with contact names, telephone numbers, and e-mail addresses for each.
 - b. A list of procedures, inclusive of testing equipment and best practices, for testing the integrity of the cabling systems on this project.
 - c. A technical resume of experience for the contractor's project manager and on-site installation supervisor who shall be assigned to this project.
 - d. A list of technical product training attended by the contractor's personnel that shall install the structured cabling systems shall be submitted.
 - e. Any subcontractor who shall assist the contractor in performance of this work shall have the same training and certification as the contractor.
 - 6. The Contractor shall employ full time local technicians and installers.
- B. The Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.

1. Items requested by the Owner/Engineer to finalize rack equipment configuration, rack cable management, rack cable terminations and other miscellaneous minor changes shall become part of the Contract Documents as supplementary information.
- C. The products specified in Part 2 of this Specification shall be supplied by a single manufacturer, within the acceptable manufacturer groups, except for data racks and other hardware that is not defined as part of the channel test configuration by TIA/EIA TSB67, Transmission Performance Specifications for Field Testing of unshielded Twisted-Pair Cabling Systems outside plant (OSP) copper cable. Manufacturer shall have a minimum of seven (7) years' experience and shall be ISO 9001 Certified.
- D. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E. 25% of the installation technician's staff shall, at a minimum, carry manufacturer's installation certification.

1.3 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
 1. Local Building Code
 2. Local Electrical Code
 3. NEC National Electrical Code
- B. Other References:
 1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
 2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
 3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
 5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
 6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. ANSI/TIA-492-AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
 8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
 9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
 10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
 11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
 12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
 13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
 14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
 15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
 16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure
 17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)

19. TIA/EIA 942 Data Center Standards
20. Current BICSI Telecommunications Distribution Methods Manual
21. NFPA 70 – National Electrical Code (NEC).
22. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).

- B. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.4 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- | | |
|------|---|
| IDF | Intermediate Distribution Frame |
| MDF | Main Distribution Frame |
| UTP | Unshielded Twisted Pair |
| SCS | Structured Cabling System |
| RCDD | Registered Communications Distribution Designer |

1.5 SUBMITTALS

- A. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of Notice to Proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD. The RCDD certification shall have been granted on or renewed before three years previous of proposal due date. Certification shall be current.
 2. Products: Provide standard manufacturer's cut sheets and/or other descriptive information.
 3. Testing: UTP cable test result forms, fiber optic cable test result forms, and a list of instrumentation to be used for systems testing.
 4. Provide a line-by-line item specification review indicating compliance or deviation with full description of deviation.
 5. Samples: Complete manufacturer's product literature and samples of patch panel, fiber terminations, and station jacks with cover plate.
 6. Provide coordination drawing with IDF/MDF equipment layout and rack elevations for approval, by Owner, prior to installation.
- B. Documentation: Contractor shall provide documentation to include test results, and shop drawings. An example of test results as they will be presented should be included with the shop drawings.
1. Work Station Cable Results: The results of the workstation cable tests shall be provided in the form of printouts from the test equipment as well as in the native format of the provided tester.
 2. Work Station Cabling Shop Drawings: Provide a set of shop drawings, indicating work station labeling, and closet origination location. Provide PDF copies and 30"x42" acrylic printed maps in each closet.
 3. Fiber Test Results: Hand written results are not acceptable. Copies of test results are not acceptable. Results to be provided on disk and printed form.
- C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Complete manufacturer's product literature for all products installed during the course of the Project for Operation & Maintenance.

2. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed conforms to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all connectivity testing was completed and that all irregularities were corrected prior to job completion.
 3. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. Provide three printed (3) copies.
 4. As-built Drawings shall include equipment layout and rack elevations. The as-built drawings shall be prepared using AutoCAD 2014 electronic format or later, with PDFs provide on CD.
 5. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
 6. Submit proof that all system components and cables are U.L. Listed.
 7. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
 8. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
- D. Bill of Materials: The contractor shall provide an itemized pricing breakdown for the turnkey solution that includes: labor, materials, wiring, termination, electrical equipment, electrical hardware, installation, etc. Pricing breakdown shall include the list price for each item provided.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the TIA/EIA specifications.
- B. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:

CM	Communications Cable
CMP	Plenum Rated Communications Cable
CMR	Riser-Rated Communications Cable
OSP	Outside Plant Cable
- C. Initial Cable Inspection: The contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.
- D. Cable specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.

2.2 ACCEPTABLE MANUFACTURERS

- A. Horizontal Cabling Systems:
 1. Commscope NETCONNECT

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
- B. Backbone Cabling Systems:
 - 1. Commscope
 - C. Above-Ceiling Support Systems:
 - 1. Tomarco CEAS
 - 2. Panduit
 - 3. Caddy
 - 4. Arlington
 - D. Head-End Systems:
 - 1. Chatsworth (CPI)
 - 2. Hoffman
 - 3. Commscope
 - 4. APC
- 2.3 PERFORMANCE REQUIREMENTS
- A. Horizontal Cabling System
 - 1. Cable:
 - a. The Structured Cabling System provided shall be unshielded twisted pair, four-pair, solid copper conductor, meeting the intent and quality level of the TIA/EIA-568 Commercial Building Wiring Standard.
 - b. Cabling shall be rated CMP.
 - c. Shall be Category 6 for all drops. Shall be Commscope CS37P.
 - 2. Jacks:
 - a. Flush mount jacks shall be high quality 8p 8c modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware.
 - b. Shall be standard 8-position, RJ-45 Style, FCC compliant
 - c. Shall be designed for 4-pair, 100 Ohm balanced UTP Cable
 - d. Shall terminate 26-22 AWG solid or stranded conductors
 - e. Shall accept FCC compliant 6 position plugs.
 - f. Shall have attached wiring instruction labels to permit either T568A or T568B wiring configurations.
 - g. Shall be backward compatible with existing Category 3, 5 and 5E cabling systems for fit, form and function
 - h. Shall meet or exceed transmission requirements for connecting hardware, as specified in ANSI/TIA/EIA-568-C2, Transmission Performance Specifications for 4-Pair 100 Ohm.
 - i. Shall be UL Listed and CSA certified.
 - j. Each jack shall have category rating identified on the front face.
 - k. Shall be Category 6 for all drops. Commscope SL Series, no approved equal.
 - 3. Patch Cords
 - a. Shall be factory terminated, snag less without strain-relief boot
 - b. Shall match manufacturer of horizontal cabling system
 - c. Shall be Category 6 for all drops.
 - d. Patch Cables shall be provided by Contractor for each station outlet and each patch panel jack (i.e. 2 cables per drop/tie cable). Patch cables shall be pinned per EIA 568B and shall be terminated with 8p8c non-keyed plugs at both ends. Patch cords shall be a length suitable to neatly run from farthest two jacks on patch panel and still provide slack to dress cable.
 - 4. Faceplates.
 - a. Minimum four (4) ports
 - b. Blank grey insert covers shall be provided for unused workstation ports.

- c. Wall mount phone faceplate
 - d. Provide 106-Style frame for floor-mounted boxes
 - e. Faceplates shall be compatible with standard NEMA openings and boxes.
 - f. Faceplates shall be UL Listed and CSA Certified
 - g. All faceplates must contain ID windows
 5. Cabling Support Systems
 - a. J-Hooks or Saddle Bags
 - 1) Hold up to 5" diameter bundle of cable without sagging, bending or damaging cable.
 - 2) All Velcro used above ceilings must be rated CMP.
 6. Labels
 - a. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding data outlets. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-built drawings and to final test reports.
 - b. Contractor shall ensure complete durable laser printable cable labels typed labeling of all outlets and cables with numbers that correspond to locations on the punch down block. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.
 - 1) Durable laser printable cable labels.
 - 2) Durable Polyester label stock.
 - 3) Self -Laminating wrap around design.
 - 4) Clear Polyester with White and Colored Print-on areas.
 - 5) Polyester rated for indoor and outdoor applications.
 - c. Patch Panel Port Identification.
 - d. Face Plate and Port Labels.
 - e. Rack and Cabinet Labels.
 - f. Fiber Adapter Labels
- B. Backbone Cabling System
 1. Physical Characteristics:
 - a. Shall be suitable for use in indoor or outdoor applications.
 - b. Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
 - c. Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
 - d. Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
 - e. Suitable for underground or aboveground conduits.
 - f. Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
 - g. Shall have a ripcord for overall jacket.
 - h. Shall be in an armored jacket. Ensure bonding on both sides of armored jacketing, for all cabling. All fiber that is to be ran outside to be di-electric, all indoor fiber to have an interlocking fiber.
 2. Each Single-mode Fiber shall be:
 - a. Dispersion - unshifted single mode optical fibers with Low Water Peak complying with ITU-T G.652.D and with improved bending loss complying with ITU-T G.657.A1.
 - b. The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm². Dispersion measurements shall be

- 1 made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-
2 175-B.
- 3 c. The nominal mode field diameter shall be 9.2m with a tolerance of 0.4m at
4 1310 nm when measured in accordance with ANSI/EIA/TIA 455 191 B.
- 5 d. Transmission Characteristics:
- 6 e. Maximum cabled attenuation for loose tube fibers shall be 0.4/0.3 dB/km @
7 1310/1550 nm.
- 8 f. Maximum cabled attenuation for tight buffer fibers shall be 0.7/0.7 dB/km
9 @ 1310/1550 nm.
- 10 g. The cabled cutoff wavelength shall be 1260 nm when measured in
11 accordance with ANSI/EIA/TIA-455-80-C
- 12
- 13 3. Each Multimode Fiber shall be:
 - 14 a. Graded-index optical fiber wave-guide with nominal 50/125um-core /
15 cladding diameter.
 - 16 b. The fiber shall comply with the latest revision of ANSI/EIA/TIA-
17 492AAAC.
 - 18 c. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
 - 19 d. Information transmission capacity shall be measured in accordance with the
20 latest revision of ANSI/EIA/TIA-455-204.
 - 21 e. The measurements shall be performed at 23 degrees C \pm 5 degrees C.
 - 22 f. Maximum attenuation dB/km @ 850/1300 nm: 3.0/1.0
 - 23 g. EMB Bandwidth 2000 MHz-km @ 850nm.
 - 24 h. OFL Bandwidth 500 MHz-km @ 1300nm.
 - 25 i. Optical Fiber shall be Bend-insensitive Laser Optimized and guarantee 1
26 Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm,
27 respectively.
 - 28 j. Optical fiber shall guarantee a 10-Gigabit distance of 300m OM3, or OM4
29 for anything over 300m.
- 30
- 31 C. Backbone Copper:
 - 32 1. Cat 6 – Match horizontal cabling
- 33
- 34 D. Head-End System
 - 35 1. Racks/Grounding
 - 36 a. Floor Standing 2-Post Racks
 - 37 1) 7' Tall
 - 38 2) Black
 - 39 3) Chatsworth 55053-703
 - 40 b. Patch Panels
 - 41 1) 24/48-Port – Commscope UDDM Series
 - 42 c. Ladder Rack
 - 43 1) Black
 - 44 2) 12" Wide – Commscope CR-SLR-10L12W
 - 45 3) Elevation Kit – Chatsworth 10506-706
 - 46 4) Top Plate Kit – Commscope CRR2RRMK
 - 47 5) Wall Angles – Commscope CR12-C24WRSK
 - 48 6) Vertical Wall Mount Kits – Commscope CRVWBK
 - 49 7) Waterfalls – Commscope CRDK-12W
 - 50 8) End Cap Kit – Commscope CRPECK
 - 51 9) Junction Splice Kit – Commscope CRTJSK
 - 52 10) 90 Degree Radius Bend – Commscope CR90FCB-12W
 - 53 d. Grounding
 - 54 1) #6 AWG copper grounding wire
 - 55 2) 12" grounding bus bar, TMG pattern
 - 56 3) 2-hole grounding lugs

- e. Horizontal Wire Managers
 - 1) Black
 - 2) Double-Sided
 - 3) Hoffman DCHD2
- f. Vertical Wire Managers
 - 1) Black
 - 2) Double-Sided
 - 3) Hoffman DV10DF7
- 2. Fiber Head-End Systems
 - a. Fiber LIU
 - 1) 2RU – IDF
 - b. Bulkheads
 - 1) 12-Port Duplex
 - 2) Multi-Mode SC – Commscope 559596-5
 - 3) Single-Mode SC- Commscope 559596-2
 - c. Connectors
 - 1) Multi-Mode SC – Commscope MFC-SCR-09-BG
 - 2) Single-Mode SC- Commscope SFC-SCR-09-BL
 - 3) Patch Cords
 - a) 3-Meter
 - b) LC-LC terminations

PART – EXECUTION

3.1 GENERAL

- A. At completion, the horizontal cabling system shall be inclusive of Cat 6, jacks, faceplates, patch cords, above-ceiling supports, labels, testing, and all supporting equipment to provide a complete solution as described in this specification.
- B. At completion, the backbone cabling system shall be inclusive of fiber, multi-pair copper, connectors, bulkheads, patch cords, above-ceiling supports, testing, and all supporting equipment to provide a complete solution as described in this specification.
- C. At completion, the head-end system shall be inclusive of 2-post racks, patch panels, fiber termination boxes, wire managers, ladder rack, fire-rated plywood, power-strips, grounding and all supporting equipment to provide a complete solution as described in this specification.
- D. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Engineer may observe before acceptance.
- E. All clean-up activity related to work performed shall be the responsibility of the contractor and shall be completed daily before leaving the facility.

3.2 COORDINATION

- A. It is encouraged that the contractor be familiar with the site and existing district infrastructure before submitting proposal. Congested building areas shall be inspected by the contractor to ensure coordination with the other trades during construction. No extras shall be permitted because of the contractor's failure to properly investigate existing conditions or building design at the time of the proposal.

- 1 B. The Contractor shall coordinate with other system vendors, where appropriate, to facilitate
2 equipment installation, scheduling, protection of equipment and access to the project site in
3 order to provide the Owner a substantially complete project in a timely manner

4 3.3 HORIZONTAL CABLING

5 A. Colors/Types

- 6 1. Commscope CS37P Cable
7 a. Data/Voice - Blue
8 b. Wireless Access Points – Yellow
9 c. CCTV - Green
10 2. Jacks
11 a. Data - Blue / UNJ Series: UNJ600T
12 b. Voice - Blue / UNJ Series: UNJ600T
13 b. Wireless Access Points – Yellow / UNJ Series: UNJ600T-YL
14 c. CCTV – Green / UNJ Series: UNJ600T-GR
15 3. Patch Cords
16 a. Data – Blue (1) 10’, (1) 6’
17 b. Voice – White (1) 10’, (1) 6’
18 c. Wireless Access Points – Yellow (1) 10’, (1) 6’
19 d. Card Reader/Intrusion System – Violet (1) 10’, (1) 6’
20 e. CCTV – Green (1) 10’, (1) 6’
21 4. Faceplates: Commscope M series
22

23 B. Installation

- 24 1. Horizontal Cabling
25 a. One (1) cable shall be provided for each port shown on the drawings, unless
26 otherwise shown on drawings.
27 b. The cabling shall be installed per requirements of the manufacturer and the
28 Project Documents, utilizing material meeting all applicable TIA/EIA
29 standards. The contractor is responsible for providing all incidental and/or
30 miscellaneous hardware not explicitly specified below as required for a
31 complete and operational system.
32 c. Cable shall not run close (6 inches’ perpendicular, 12 inches parallel) to
33 power conduits (and other electrical noise sources). No patch panel, cable,
34 outlet or punch block shall be within 6 feet of transformers or 12 inches of
35 fluorescent lights, light fixtures, A/C wiring, radio systems or any other RF
36 emitting device in ceilings or in/on walls.
37 d. Furnish and install pull strings in all new conduits, including all conduits with
38 cable installed as part of this contract. Pull test is not to exceed 200 pounds.
39 e. Conduit sleeves shall be provided from outside IDF/MDF location to below
40 ceiling area above ladder rack inside IDF/MDF. Minimum conduit size for
41 data cabling sleeves shall be 4 inches.
42 f. Any data cabling installed in any conduit that is run underground in or under
43 building slab shall be outside plant rated and sealed at each end with approved
44 gel cable/conduit sealant.
45 g. Cable runs shall be free of splices, kinks, excessive slack, and damage to the
46 outer jacket
47 h. Cables shall not be painted. Any painted cable shall be replaced, at no cost to
48 the owner.
49 i. Cables shall be placed with sufficient bending radius so as not to kink, shear
50 or damage the cable jacket or to otherwise diminish the transmission
51 capability of the wire inside.
52 j. Cable and/or cable bundles shall not be attached to any electrical wiring or
53 light fixtures, nor will its vertical deflection allow it to encounter HVAC

- mechanical equipment, electrical wiring, conduits, piping, or fluorescent light fixtures.
- k. All data cables shall be home runs from outlet at final termination to patch panel at IDF/MDF.
- l. Cable Termination:
- 1) Number of twists per foot shall be maintained all the way to cable termination point.
 - 2) Provide 10' foot service loop above ceiling for each above ceiling terminated drop, on workstation and 10' on the head-end side.
 - 3) Cable shall be terminated using tools specified by the cable manufacturer.
- m. Cable Support
- 1) In suspended ceiling and raised floor areas where duct, ladder trays or conduit are not available, the Contractor shall bundle, in bundles of 50 or less, station wiring with j-hooks, but not deforming the cable geometry. Cable bundles shall be supported and attached to the building structure and framework at a maximum of five (5) foot intervals.
 - 2) Cables shall not be attached to lift out ceiling grid supports or laid directly on the ceiling grid.
 - 3) Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.
- n. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- o. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
- p. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- q. Mounting heights shall conform to the Local Building Code Accessibility Standards. Mounting height shall match adjacent wiring devices unless noted otherwise.
- r. Contractor shall not hang cabling on pipes or wiring looms. Provide and install separate J-Hooks, cable saddles or ladder trays to carry cable plant that is installed. Cable support shall be secured to building structure.
- s. Cable shall run parallel and perpendicular to building lines. Changes in direction will be made with smooth bends, not exceeding minimum bend radius.
- t. Patch Cords:
- 1) Furnish and install quantity one (1) 10', one (1) 6' for each cabled provided.
- u. Emergency phone copper – Shall be provided, at minimum, at the following locations, coordinate with drawings for locations of devices:
- 1) Emergency phone locations.
 - 2) Elevator Machine Room
 - 3) Building Management Control Panel Locations
 - 4) Security System.
 - 5) Fire Alarm Panel
- v. Wireless Access Points:
- 1) Install each outlet above ceiling in biscuit style termination of same design as station hardware. Shall also have label to match cable label on grid directly below provide biscuit block. Shall be black label with white letter. Each device shall have a 15' service loop.
- w. Security Cameras:

- 1) Install each outlet above ceiling in biscuit style termination of same design as station hardware. Shall also have label to match cable label on grid directly below provide biscuit block. Shall be black label with white letter. Each device shall have a 15' service loop.
- x. Damage:
- 1) The Contractor shall replace or rework cable showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and excessive cable sheath has been removed.
- 2) The Contractor shall replace any damaged ceiling tiles that are broken during cable installation. Ceiling tiles shall match existing or new as specified elsewhere.
- 3.4 TELECOMMUNICATIONS OUTLET WIRING INSTALLATION
- A. General:
1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connections points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
- B. Exposed Cable: All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed station cable shall only be run where indicated on the Drawings. Additional exposed cable runs shall require Owner approval and shall only be allowed when no other options exist. Cabling shall be installed concealed at all times, except in unfinished mechanical rooms or wiring closets where cable shall be installed exposed and located to avoid conflicts with pass-through cabling, etc. Tie wraps shall be used to provide a neat appearance. Provide Velcro straps to dress the cable.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Minimum Bend Radius and Maximum Pulling Tension:
1. Do not exceed bend radius for UTP = 4 X Cable OD, FTP = 4 X Cable OD.
2. Install unshielded twisted-pair cables so that there are no bends smaller than 4 times cable outside diameter at any point in the run and at the termination field.
3. Pulling Tension on 4-Pair UTP Cables: Do not exceed 25 ft.lb. for 4-pair UTP cable.
- E. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).
- F. Bend Radius of Horizontal Cables:
1. Not less than 4 times OD of UTP cables.
2. Not less than 4 times OD of FTP cables.
- G. Maintain cable jacket to within 25 mm (1 inch) of termination point.

3.5 BACKBONE CABLING

- 1 A. Colors
- 2 1. Fiber:
- 3 a) OM3/4 – Aqua – Commscope P-012-DZ-5K-FSUAQ (within building), P-
- 4 012-LN-5L-F12BK/25D (between buildings)
- 5 2. Backbone Copper
- 6 a) Cat 6 – Match horizontal cabling
- 7
- 8 B. Installation
- 9 1. Fiber:
- 10 a) Provide and install 12-strand single-mode between MDF and each new IDF
- 11 b) Provide and install factory terminated LC connectors, quantity to match
- 12 number of strands installed.
- 13 c) Provide and install quantity four (4) 3- meter LC-LC patch cord, factory
- 14 terminated, for every backbone run, per fiber type.
- 15 d) Provide 10' service loop on each side of the fiber homerun.
- 16 2. Copper Backbone:
- 17 a) Provide and install quantity two (2) – Category 6 Cables between the building
- 18 MDF and each new IDF.
- 19 b) Provide and install quantity of connectors necessary to terminate one pair per
- 20 port, on both sides.
- 21 c) Provide and install quantity (1) patch cord for each connector provided.
- 22 d) For each copper pulled between buildings, provide surge suppressions,
- 23 keeping mind to ground all suppressions.
- 24 e) Provide 10' service loop on each side of the fiber homerun.
- 25 f) Provide and install 24-Port Patch Panel in each closet for termination of
- 26 backbone copper
- 27

28 3.6 HEAD-END SYSTEMS

29

- 30 A. Installation
- 31 1. Floor Mounted Equipment racks shall be assembled and mounted in IDF/MDF
- 32 locations as required in locations indicated on the drawings. Each rack shall be
- 33 securely mounted to the floor and braced to the wall with ladder tray in accordance
- 34 with the manufacturer's instructions and recommendations. Racks shall be mounted
- 35 such that the side rails are plumb. Racks and ladder tray shall be grounded in
- 36 accordance with NEC requirements. Rack shall be installed for future expansion and
- 37 with proper access behind after electronic equipment is installed.
- 38 2. Coordinate final rack configurations with owner, prior to installation of all
- 39 components.
- 40 3. Backboard: Furnish and install an equipment backboard at each MDF/IDF equipment
- 41 location. Backboard shall be 3/4" x 8' x 4' Minimum Grade AC fire retardant plywood,
- 42 with fire retardant paint. Coordinate placement of all equipment with Owner. Two
- 43 walls of every closet shall be covered from floor to ceiling.
- 44 4. Wire Management Components: Vertical cable management panels shall be installed
- 45 on each side of the rack. In instances where more than one rack is installed in a single
- 46 location, vertical cable management shall be installed between the racks. Horizontal
- 47 wire management to be installed between each patch panel, and at the top and bottom
- 48 of each rack.
- 49 5. Cable Placement: Cable installation in the wiring closet must conform to the Project
- 50 Drawings. All cabling shall be routed so as to avoid interference with any other service
- 51 or system, operation, or maintenance location. Avoid crossing areas horizontally just
- 52 above or below any riser conduit. Lay and dress cables to allow other cables to enter
- 53 the conduit/riser without difficulty at a later time by maintaining a working distance
- 54 from these openings.

- 1 6. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure
2 that adequate wall or backboard space is available for current and future equipment.
3 All cable runs within the wiring closet shall be horizontal or vertical within the
4 constraints of minimum cable bending radii. Minimum bend radius shall be observed.
5 Cables shall not be tie-wrapped to electrical conduit or other equipment. All incoming
6 cables shall be routed on the ladder tray and neatly dressed down to the patch panels.
7 7. For each new IDF closet provide and install one (1) UPS system, as specified above.
8 For each rack installed provide (1) vertical mount PDU.
9 8. No conduit shall exceed 40% fill ratio, provide an additional conduit if ratio is reached.
10
11 B. Grounding: Each closet shall be grounded to building steel, water pipes.

12 3.7 HORIZONTAL & BACKBONE CABLE TESTING/BALANCING

- 13 A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so
14 that the testing may be witnessed.
15
16 B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series
17 of end-to-end installation performance tests. The Contractor shall submit for approval a
18 proposal describing the test procedures, test result forms and timetable for all copper and fiber
19 optic cabling.
20
21 C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures
22 discussed below is predicated on the Contractor's use of the recommended products and
23 adherence to the inspection requirements and practices set forth. Acceptance of the completed
24 installation shall be evaluated in the context of each of these factors.
25
26 D. Errors: When errors are found, the source of each error shall be determined, corrected and the
27 cable retested. All defective components shall be replaced and retested. Retest results must be
28 entered on the test results form. All corrections shall be made prior to final acceptance test.
29
30 E. Twisted Pair Cable Testing
31 1. At a minimum, the Contractor shall test all station drop cable pairs from data closet
32 termination patch panel port to station insert. Products shall be tested for compliance
33 to ANSI/TIA/EIA 568 and ISO/IEC 11801 for a rated installation. Test equipment
34 used shall meet TIA/EIA TSB-67, Level 4 accuracy. Further, the Contractor shall have
35 a copy of TSB-67 in their possession and be familiar with its contents. Testing shall
36 be against either appropriate category standards or the manufacturer's specifications
37 whichever is more stringent and applicable.
38 2. Each wire/pair shall be tested at both ends for the following:
39 a. Wire map (pin to pin connectivity)
40 b. Length (in feet)
41 c. Attenuation
42 d. Near End Cross Talk (NEXT)
43 e. Power Sum
44 f. Structural Return Loss
45 g. Delay Skew
46 h. PSNEXT
47 i. ACR – must produce ACR results for every 6A cable, showing passing rates
48 for bundled cables
49 j. PSACR
50 k. Equal Level Far End Crosstalk (ELFEXT)
51 l. PSELFEXT
52 m. Far End Crosstalk (FEXT)
53 n. Propagation Delay

3. Test equipment shall provide an electronic and printed record of these tests. Test equipment calibration documentation shall be available for on-site inspection.
4. Test results of each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and 8p8c jacks and must match as-builts associated with that cable.

F. Fiber Optic Cable Testing

1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test trace and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as LC connector terminations.
2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
3. After installation, the Contractor shall test each intra-building fiber strand with a power meter in accordance with EIA 455-171 Method D procedures (bi-directional testing) at both 850 and 1300 nm. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end to end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
4. Acceptable fiber optic cable and connector loss shall not exceed 1.5 dB. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.

G. Acceptance of the Data Communications Cabling System shall be based on the results of testing, functionality, and the receipt of documentation. With regard to testing, all fiber segments and all workstation data cables must meet the criteria specified. With regard to functionality, the contractor must demonstrate to the Owner that 1000 Base-T data signals can be successfully transmitted, bi-directionally, from the MDF and from some number of individual data outlets. The number of outlet locations to be tested shall be determined by the Owner.

H. Coordinate with Architect and Owner's Information Systems Department the required SCS identification prior to construction. Exact nomenclature for identification shall be submitted in writing to the Architect for review prior to final identification.

I. Cable Drop Label Nomenclature:

1. Cable and pathway administration will comply with ANSI/TIA 606-B.
2. Format of cable, faceplate insert, and patch panel port label will be the same
3. The MDF identifier is "M"
4. Each IDF identifier will be an "I", with a unique numeric character (e.g. "I#")
5. Next identifier will be the patch panel within the given closet, starting from the top with A-Z in sequential order.
6. Cable terminated to upper left port on first patch panel will be A01, cable terminated to upper left port on second patch panel will be B01 (presupposing the first patch panel is a 48-port patch panel)
 - a. Examples: M-A01, I12-B35

3.8 WARRANTY

- A. The Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).
- B. A twenty (20) year extended product warranty and application assurance for this structured cabling system shall be provided as follows:

SECTION 27 50 00

EXPANSION OF EXISTING SCHOOL COMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete expansion of the existing school communication system as required.
 - 1. A complete system includes items such as wiring, handsets, control consoles, and main distribution equipment.
 - 2. Integrate all components to provide a complete and functioning system.
- B. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.
- C. Integrate the communication system with the following systems:
 - 1. Bell System
 - 2. Owner's VoIP system
 - 3. Local Sound Reinforcement Sound Systems
- D. Return air plenum cable shall be used. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.

1.2 QUALITY ASSURANCE

- A. Provide the system by a company that has been designing and supplying similar systems for a period of 3 years. Provide, upon request by Owner or Engineer names and addresses of similar installations.
- B. Provide central processing control console wiring connections by factory engineers or authorized factory trained personnel.

1.3 WARRANTY

- A. Warranty equipment and installation for a period of 1 year, from date of substantial completion.
- B. Correct defects in material or workmanship with a minimum loss of operating time at no cost to Owner.
- C. On-site service within 24 hours of notification.

1.4 SUBMITTAL

- A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
 - 1. Wiring and interconnection schematics.
 - 2. Complete point-to-point wiring diagrams
 - 3. Riser diagrams.
 - 4. Complete floor plan drawings locating all system devices.
 - 5. Factory data sheets on each piece of equipment proposed.
 - 6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
 - 7. Complete system bill of material.
 - 8. Line by line specification review stating compliance or deviation.

EXPANTION OF EXISTING SCHOOL COMMUNCATION SYSTEMS

B. All submittal data will be in bound form with Contractor's name, Supplier's name, and project name adequately identified.

C. Minimum size drawings: 11" x 17".

1.5 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the communication system with all other trades.

B. Pre-installation meeting: Schedule a pre-installation meeting specifically for the School Communication System with Owner and Engineer.

1.6 REFERENCES

A. National Electrical Code.

B. UL

C. Communication systems connected to a telephone utility company shall comply with the Federal Communications Commission Rules Section 68 and the corresponding UL listing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. School Communications Head-End/Console Equipment

1. Carehawk CH1000
2. Carehawk Security Switching Card 16/32 port
3. Dukane Starcall – Existing Head-End Solution

B. Speakers/Attenuators

1. Quam
2. Atlas Sound

C. Cable

1. Windy City Wire
2. Tappan
3. Approved Equal

D. UPS

1. Tripplite

2.2 HEAD-END EQUIPMENT

A. The central equipment shall be mounted in a standard 19" equipment rack. The central equipment shall consist of but not be limited to:

1. The equipment rack shall be provided by Division 27 10 00.
2. A power supply to provide operating DC power for the circuitry contained within the central equipment housing and all administrative control stations (ACSs) shall be provided.
3. A central microprocessor unit containing all solid-state memory and components necessary to provide the features specified herein.
4. Zone circuit boards as required to meet the system requirements for remote stations and/or communications linkage.
5. The provision for terminating the cabling from up to 128 remote stations and 8

- 1 administrative control stations (ACSSs) shall be provided.
- 2 6. The provisions to automatically activate a selectable program source between class
- 3 changes.
- 4 7. All necessary equipment to incorporate into existing Starcall equipment, shall be
- 5 provided.
- 6

- 7 B. Admin Phones
- 8 1. Carehawk AP1
- 9

10 2.3 ZONED PAGING AMPLIFIER

- 11
- 12 A. External paging amplifiers shall be provided as required to meet the load requirements of the
- 13 system when activated in the all-page mode. The system shall be equipped with equipment
- 14 required for (one) program channel.
- 15
- 16 B. Program/paging amplifiers shall have the following:
- 17 1. Power output shall can provide sufficient power for the speakers required to the
- 18 project and include an additional 25% capacity.
- 19 2. Maximum .5% harmonic distortion from 20-20KHz.
- 20 3. Frequency response of 20Hz to 20KHz +/-1 dB.
- 21 4. 90 dB signal to noise ratio at 20Hz to 20 KHz.
- 22 5. 1V RMS input sensitivity at 1KHz.
- 23 7. Master volume control.
- 24

25 2.4 EQUIPMENT RACK

- 26
- 27 A. All equipment shall be mounted within provided 2-post racks in the building's data closets
- 28
- 29 B. The program sources shall be remotely located from the control equipment. The rack shall be
- 30 a black metal finish, table top rack located as directed by the Owner.
- 31

32 2.5 SPEAKERS

- 33
- 34 A. Ceiling speakers:
- 35 1. General Purpose Speaker: 8" speaker with 5 oz. magnet complete with line matching
- 36 transformer. Program rating shall be 5 watts continuous. The speaker shall be a Atlas
- 37 Sound AT-SD72WV, or approved equivalent by Quam.
- 38
- 39 B. Exterior Speakers:
- 40 1. The speaker shall be an 8" with recessed box and baffle
- 41 2. 25/70V transformers shall have primary taps of 0.25, 0.5, 1, 2 and 5 watts. Tap
- 42 speaker at 0.25 watt.
- 43 3. Aluminum alloy grille, white finish, neoprene gasket. Atlas APF-15T.
- 44
- 45 C. Volume Attenuators:
- 46 1. Atlas Sound AT10 or approved equal by Quam.
- 47

48 2.6 NETWORK INTEGRATION

- 49
- 50 A. VoIP Integration
- 51 1. The provided system shall have the capability of integrating with the owner's VoIP
- 52 System.
- 53
- 54 B. Existing Campus
- 55 1. Existing campus Dukane Starcall system shall be integrated into newly provided
- 56 system.
- 57

2.7 UPS BATTERY BACK-UP

- A. Provide UPS Battery backup for the communications system to operate a minimum of 24 hours stand-by then 20 minutes of operation upon loss of power.
- B. Acceptable Manufacturers: Tripplite SmartPro 1500VA.

PART 3 - EXECUTION

3.1 INTERCOM SYSTEM DESCRIPTION

- A. The intercom system shall consist of a central equipment cabinet, microprocessor control unit, power supply, zone modules, administrative control stations (ACSs), amplifiers, and station loudspeaker assemblies. Provide all associated material hardware, wiring, and options as described herein to provide a complete working system, which shall meet the specified requirements.
- B. The intercom system shall provide the following communications paths and functions.
 - 1. ACS to remote loudspeaker station (provide two channels).
 - 2. Administrative control station to administrative control station.
 - 3. Remote speaker to administrative control station.
 - 4. Zone paging.
 - 5. Network IP Mass Notification
- C. The system shall be designed to accomplish any combination or all of the above functions simultaneously.
- D. The system shall provide the facilities for the paging or sounding emergency signals or time event signals to selected groups or all remote speakers.
- E. The system shall provide facilities for the control and distribution of up to two program channels to individual, selected groups, or all remote speakers, as well as intercom communications and class change signals.
- F. The system shall include the facilities of a built-in master clock and programmer capable of correcting appropriate secondary clock displays and controlling events based on user programmed time schedule programs.
- G. Provide remote control of program distribution. Distribution of the program source shall be possible from any administrative control station (ACS).
- H. Zone system as follows:
 - 1. All speakers in corridors shall be zone area designation. (ie. all speakers in corridors in the 100 series rooms, all speakers in corridors in the 200 series rooms. etc. etc.)
 - 2. Restrooms, Toilets, Electrical Rooms, Mechanical Rooms, Telephone Closets, Data Closets, Offices Janitor's Rooms, and Storage Rooms shall be zoned with the nearest corridor zone.
 - 3. All outside horns shall be one zone.
 - 4. Each individual room such as and not limited to classrooms, cafeteria, kitchen office, conference room and gymnasium shall be an individual zone.

3.2 INTERCOM SYSTEM FUNCTIONS

- A. The system shall allow for user definable pre-selective access to "zone" and "all-page" functions. This feature will prevent unauthorized paging from designated ACSs.
- B. Provisions shall be provided inherent to the system, to allow for the use of a priority override

inputs (i.e. principal's microphone and telephone extension). This circuit, when activated by an external source, shall gather all speakers for distribution of the signal information provided by the external source. This priority override input shall preempt other functions currently under way in the system. Upon conclusion of the priority override function, all pre-empted functions shall be automatically restored.

- C. The system shall have the capability to operate with external paging amplifiers to increase the audio output available for paging. Adequate audio amplification in zoned shall be provided as required.
- D. The system shall be equipped with control point outputs and activate outboard devices such as priority override muting relays on remote local sound reinforcement systems. The control point outputs shall be activated when the system is placed in the emergency page mode or if the emergency tone generator is activated and shall mute the output of the local sound reinforcement system.
- E. System must allow simultaneous operation of both diagnostic and functional routines (paging, zone page, time events, call-in, etc.).
- F. The system shall can perform scan functions from the administrative control stations or computer terminal for:
 - 1. Review of call-in coverage assignments to an ACS.
 - 2. Review ID numbers of remote stations assigned to either of the two program channels.
 - 3. Review that ACSs are forwarding coverage.
- G. Higher priority calls shall not cancel when the "Clear All Calls" routine is used. Only normal calls shall clear and cancel.
- H. Line loss on two-way communications circuits to be no greater than .5dB per 500 feet of circuit length.
- I. The system shall be provided with the capability to activate an emergency tone / signal / wav file from remote emergency pushbuttons located throughout the building. Deactivation shall require pass-word protected access from an ACS.
- J. Existing Dukane Starcall system to be integrated into newly provided CH1000. Provide all necessary programming to allow initiation from newly provided Admin Phones, VoIP phones, and all existing equipment to operate seamlessly.
- K. Each data closet shall receive an appropriately sized Security Switching Card, quantity as necessary to facilitate all communication within a served area, plus an additional 10% capacity.

3.3 INSTALLATION

- A. General: Install new communication system components in accordance with the manufacturer's instructions.
 - 1. Terminate all field wiring on telephone punch blocks mounted in an enclosure as specified.
 - 2. Label cables and wiring logically, legibly, and permanently for ease of identification, using adhesive strip type labels.
 - 3. All communications wire and cables, which are to be routed in the ceiling spaces shall be identified and tagged at the end and beginning of every home run. The identification shall include the room number on markers like T&B sleeve marker.
 - 4. Provide integration of local sound reinforcement system override.

- 1 B. Speaker Installation:
- 2 1. Install new speaker's types as indicated on the drawings.
- 3 2. Speakers in high ambient noise areas (cafetorium, gymnasiums, etc.) Shall be tapped
- 4 at maximum level, to overcome the ambient noise generated by the public.
- 5 3. Provide silicone sealant to all openings and conduit penetrations at all exterior back
- 6 box locations.
- 7
- 8 C. Conduit and Cables
- 9 1. Install conduit, fittings and boxes as specified in Division 26.
- 10 2. Single system cables shall be grouped together in a common conduit of adequate
- 11 capacity to facilitate the ease of installation and prevent conductor or insulation
- 12 damage.
- 13 a. In no case shall the conduit fill exceed 50% capacity.
- 14 b. Do not group conductors or cables of different systems in a common
- 15 conduit.
- 16 3. Cable:
- 17 a. Install cables as recommended by the system manufacturer. Conductor
- 18 quantities specified are minimum required. Conductors to be installed shall
- 19 be coordinated with the system equipment supplier.
- 20 b. Cables installed on exposed surfaces, in inaccessible locations, or
- 21 underground shall be installed in conduit.
- 22 c. Cables installed above accessible, ceiling spaces may be installed without
- 23 conduit. All cables not installed in conduit shall be plenum rated.
- 24 4. Cables not installed in conduit shall be grouped and bundled. Cable shall be bundled
- 25 on a maximum of 2'-6" on center. Support cables from D-rings or J-hooks. D-rings
- 26 and J-hooks shall be secured to the structure at a maximum of 5' on center. Bundling
- 27 and support shall be with plenum rated cable ties.
- 28 5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible
- 29 location.
- 30 6. Tag each circuit at each end and at each terminal with a separate tag indicating the
- 31 area served.
- 32 6. Remote Source Output Volume Control: Rack mounted in remote source rack.
- 33 Provide line level volume control of output of each remote source device. Label each
- 34 volume control for each output device.
- 35 7. Provide (20) "Live" intercom circuits for future portables. Wiring is to be pulled
- 36 from headend to exit point. Punch down on 66 block above ceiling above exit door to
- 37 future portable building area.
- 38

39 3.4 INSTRUCTIONS

40

- 41 A. Provide four hours' instruction to the operating/maintenance personnel, which shall include
- 42 initial programming of eight schedules.
- 43

44 3.5 TESTING AND ACCEPTANCE

45

46 A. General

- 47 1. After completion of installation and start-up procedures, commence a verification
- 48 and testing sequence leading to final acceptance.
- 49 2. Submit for approval, a sample of the form on which the test will be reported.
- 50 a. Identify project.
- 51 b. Provide a list of all system devices, arrange in numerical order of point
- 52 addresses.
- 53 1) Show descriptor and location of each.
- 54 c. Signatures of participants and observers.
- 55 d. Results.
- 56 e. Description of adjustment or corrections of defective components.
- 57 f. Date.

3. Provide schedule of tests. Estimate dates of significant events.
 - a. All testing shall be performed in the presences of the Owner / Engineer.
4. Test, calibrate and adjust each device in the system.
5. Verify operation of all specified functions.
6. Provide documentation of all tests and verifications as specified.

3.6 GRAPHIC FLOOR PLANS

- A. Provide two (2) color coded floor plan detailed with actual room names, actual graphic room numbers as directed by the Owner, and adequate information to indicate group / zone / circuit information with non-fading floor plan media. Do not use plan room names and numbers.
- B. Each plan shall clearly relate the room numbers on the graphics to the actual room name / number.
- C. The floor plan shall be solvent welded in acrylic plastic.
 1. Mount in an extruded aluminum frame.
- D. Install graphic floor plans as directed by Engineer / Owner prior to substantial completion. Each area or room designation shall be verified with the communication device during testing.

3.7 GROUNDING OF EQUIPMENT

- A. Racks and cabinets shall be grounded to the metallic structure of the building or to the building system power ground in accordance with NEC section 250. Securely bond equipment to the ground system through a minimum 14-gauge green insulated conductor.
- B. Electronic systems shall be grounded to the building system ground, with a maximum resistance of 0.1 ohm. Systems ground shall be a driven ground rod, building steel, or other approved ground of the building power systems ground.

3.8 SERVICE AND MAINTENANCE

- A. The contractor shall provide a 1-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal working hours. The warranty period shall begin on the date of acceptance by the Owner/Engineer.
- B. The contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

END OF SECTION

SECTION 28 01 00

ELECTRONIC SAFETY AND SECURITY OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 5 copies of complete manual in final form.

1.2 ESS OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review 1 copy of the first draft of the ESS Operating and Maintenance Manual. This copy shall contain as a minimum:
 - 1. Table of Contents for each element.
 - 2. Contractor information.
 - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
 - 4. All parts and maintenance manuals for items of equipment.
 - 5. Warranties (without starting dates).
 - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
 - 7. Operating and maintenance procedures.
 - 8. Form of Owner's Training Program Syllabus (including times and dates).
 - 9. Control operations / equipment wiring diagrams.
 - 10. Coordination Drawings.
 - 11. Schedule of Low Voltage Wire and Cable
 - 12. Schedule of ESS Equipment
 - 13. Schedule of ESS Field Devices
 - 14. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the (5) completed manuals in final form to the Architect/Engineer:
 - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance
 - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Four complete manuals shall be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1"; Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ESS OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
 - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
 - 2. Format:
 - a. Size: 8-1/2" x 11".
 - b. Text: Manufacturer's printed data or neatly typewritten.
 - 3. Drawings:
 - a. Provide reinforced punched binder tab and bind in text.
 - b. Fold larger drawings to size of text pages.
 - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
 - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
 - a. Title of Project
 - b. Identity of separate structures as applicable.
 - c. Identity of general subject matter covered in the manual.
 - 6. Binder as specified.
- B. Content of Manual:
 - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
 - a. Contractor, name of responsible principal, address and telephone number.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. List with each product, name, address and telephone number of:
 - 1) Subcontractor or installer.
 - 2) Maintenance contractor as appropriate.
 - 3) Identify area of responsibility of each.
 - 4) Local source of supply for parts and replacement.
 - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
 - 2. Product Data:
 - a. Include those sheets pertinent to the specific product.
 - b. Annotate each sheet to:
 - 1) Identify specific product or part installed.
 - 2) Identify data applicable to installation.
 - 3) Delete references to inapplicable information.
 - 3. Drawings:
 - a. Supplement product data with drawings as necessary to illustrate:
 - 1) Relations of component parts of equipment and systems.
 - 2) Cable Plant Layout

- b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - c. Do not use Project Record Documents as maintenance drawings.
 4. Written text as required to supplement product data for the particular installation:
 - a. Organize in consistent format under separate headings for different procedures.
 - b. Provide logical sequence of instructions for each procedure.
 5. Copy of each warranty, bond and service contract issued.
 - a. Provide information sheet for Owner's personnel, giving:
 - 1) Proper procedures in event of failure.
 - 2) Instances which might affect validity of warranties or bonds.
 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
 1. Content for each unit of equipment and system as appropriate:
 - a. Description of unit and component parts.
 - 1) Function, normal operating characteristics, and limiting conditions.
 - 2) Performance data, engineering data and tests.
 - 3) Complete nomenclature and commercial number of replaceable parts.
 - b. Operating procedures:
 - 1) Start up, routine and normal operating instructions.
 - 2) Regulation, control, stopping, shut down and emergency instructions.
 - 3) Special operating instructions.
 - c. Maintenance procedures:
 - 1) Routine operations
 - 2) Guide to trouble-shooting.
 - 3) Disassembly, repair and reassembly.
 - 4) Adjusting and checking.
 - 5) Routine service
 - d. Manufacturer's printed operating and maintenance instructions.
 - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - 1) Items recommended to be stocked as spare parts.
 - f. Schedule of low voltage wire and cable
 - g. Schedule of ESS equipment
 - h. Schedule of ESS field devices
 - i. Each Contractor's coordination drawings.
 - 1) As installed color coded wiring and cabling diagrams.
 - j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
 - k. Other data as required under pertinent sections of the specifications.
 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
 4. Provide complete information for products specified in Division 28.
 5. Provide certificates of compliance as specified in each related section.
 6. Provide start up and testing reports as specified in each related section.
 7. Provide signed receipts for spare parts and material.
 8. Provide training report and certificates.

END OF SECTION

SECTION 28 05 00

ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28.
- B. Applicable provisions of this section apply to all sections of Division 28.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
 - 1. Americans with Disabilities Act (ADA)
 - 2. Authorities Having Jurisdiction (AHJ) - Local
 - 3. American National Standards Institute (ANSI)
 - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
 - 5. Building Industry Consulting Services International (BICSI)
 - 6. Code of Federal Regulations - Title 47
 - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
 - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
 - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
 - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
 - 11. International Electro-technical Commission (IEC)
 - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
 - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
 - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
 - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
 - 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
 - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
 - 18. National Electrical Safety Code (NESC)
 - 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
 - 20. Society of Cable Telecommunications Engineers (SCTE)
 - 21. Local Accessibility Standards

- 1 22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and*
2 *Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67,*
3 *72, 75 and 95*
4 23. Uniform Building Code (UBC)
5 24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604,*
6 *1651, 1681, 1690, 1778, 1977*
7
8 B. Resolve any code violations discovered in contract documents with the Engineer prior to
9 award of the contract. After Contract award, any correction or additions necessary for
10 compliance with applicable codes shall be made at no additional cost to the Owner.
11
12 C. This Contractor shall be responsible for being aware of and complying with asbestos
13 NESHAP regulations, as well as all other applicable codes, laws and regulations.
14
15 D. Obtain all permits required.
16
17 1.3 SUMMARY
18
19 A. Provide complete and working ESS Systems including equipment, conduit, wiring, material,
20 labor and training as described in this Specification and the Drawings. The ESS Systems
21 Drawings and Specifications are the sole property of the Architect and are not to be
22 duplicated, scanned, loaned or in any way made available to persons not designated as
23 authorized by the Architect. All ESS Systems plans and specifications are to be returned to
24 the Architect following completion of bid.
25
26 1.4 SPACE REQUIREMENTS
27
28 A. Consider space limitations imposed by contiguous work in selection and location of
29 equipment and material. Do not provide equipment or material that is not suitable in this
30 respect.
31
32 1.5 RELATION WITH OTHER TRADES
33
34 A. Carefully study all matters and conditions concerning the project. Submit notification of
35 conflict in ample time to prevent unwarranted changes in any work. Review other Divisions
36 of these specifications to determine their requirements. Extend electrical services and final
37 connections to all items requiring same.
38
39 B. Because of the complicated relationship of this work to the total project, conscientiously study
40 the relation and cooperate as necessary to accomplish the full intent of the documents.
41
42 C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends
43 of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and
44 locate bolts and fittings required to be cast in them.
45
46 D. Locate and size openings required for installation of work specified in this Division in
47 sufficient time to prevent delay in the work.
48
49 E. Refer to other Divisions of the specifications for the scope of required connections to
50 equipment furnished under other Division. Determine from the General Contractor /
51 Construction Manager for the various trades, the Owner, and by direction from the Architect /
52 Engineer, the exact location of all items. The construction trades involved shall furnish all
53 roughing-in drawings and wiring diagrams required for proper installation of the electrical
54 work.
55 1. Make final connections to all ESS equipment indicated on the drawings, except as
56 noted.

- 1
2 F. Request all Shop Drawings required in ample time to permit proper installation of all
3 electrical provisions.
4
5 G. Extend services as indicated to the various items of equipment furnished by others. Rough-in
6 for the various items and make final connections ready for operation upon placing of the
7 equipment.
8
9 1.6 CONCEALED AND EXPOSED WORK
10
11 A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or
12 above ceilings. "Exposed" is defined as open to view, in plain sight.
13
14 1.7 GUARANTEE
15
16 A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of
17 substantial completion of the project. During that period make good any faults or
18 imperfections that may arise due to defects or omissions in material, equipment or
19 workmanship. At the Owner's option, replacement of failed parts or equipment shall be
20 provided.
21
22 1.8 MATERIAL AND EQUIPMENT
23
24 A. Furnish new and unused materials and equipment meeting the requirements of the paragraph
25 specifying acceptable manufacturers. Where two or more units of the same type or class of
26 equipment are required, provide units of a single manufacturer.
27
28 1.9 NOISE AND VIBRATION
29
30 A. Select equipment to operate with minimum noise and vibration. If noise or vibration is
31 produced or transmitted to or through the building structure by equipment, piping, ducts or
32 other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify
33 such conditions at no additional cost to the Owner. If the item of equipment is judged to
34 produce objectionable noise or vibration, demonstrate at no additional cost that equipment
35 performs within designated limits on a vibration chart.
36
37 1.10 ACCEPTABLE MANUFACTURERS
38
39 A. Manufacturers names and catalog number specified under sections of Division 28 are used to
40 establish standards of design, performance, quality and serviceability and not to limit
41 competition. Equipment of similar design, equal to that specified, manufactured by a named
42 manufacturer shall be acceptable on approval. A request for prior approval of equipment not
43 listed must be submitted ten (10) days before proposal due date. Submit complete design and
44 performance data to the Architect. The Architect and Owner issue approvals of acceptable
45 manufacturers as addenda to the Construction Proposal Documents.
46
47 1.11 UTILITIES, LOCATIONS AND ELEVATIONS
48
49 A. Locations and elevations of the various utilities included within the scope of this work:
50 1. Obtained from utility maps and other substantially reliable sources.
51 2. Are offered separate from the Contract Documents as a general guide only without
52 guarantees to accuracy.
53
54 B. Examine the site and verify the location and elevation of all utilities and of their relation to the
55 work. Existing utilities indicated on the site plans are for reference only and shall be field
56 verified by the Contractor with the respective public or private utility.

1.12 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.13 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet (<i>Now referred to as TR</i>)
TR	Telecommunications Room (<i>A.K.A. TC - Telecommunication Closet</i>)
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.14 QUALITY ASSURANCE

- A. Equipment Standards:

1. System and all components shall be brand new stock from manufacturer.
2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

B. Contractor Qualifications:

At the time of Proposal, the Contractor shall:

1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

A. Provide SUBMITTALS according to Division 1 and the following.

B. Requirements:

1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

- 1 B. The Contractor shall confirm the availability of the proper power source for each piece of
2 specified equipment, through site visits and Drawings as necessary. Where proper power does
3 not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire
4 as specified under Division 26.
5

6 1.17 DATA ACCURACY
7

- 8 A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The
9 Drawings and Specifications are for the assistance and guidance of the Contractor and exact
10 locations, distances, elevations, etc., shall be governed by actual field conditions. Where
11 variations from the contract documents are required, such variations shall be approved by the
12 Architect / Owner.
13

14 1.18 SECURITY
15

- 16 A. The Contractor is responsible for complying with all of the Owner's and facility security's
17 requirements to prevent theft or damage to equipment, tools and materials. If any deviation
18 from facility security requirements is necessary, approval for such deviation shall be
19 coordinated with the Owner.
20

- 21 B. The Contractor shall not disclose any confidential information of the Owner. The Contractor
22 acknowledges that such action is highly injurious and can do damage to the Owner. The
23 Contractor will agree to and comply with the standard policies and provisions of the Owner
24 regarding outside Contractors and Consultants.
25

26 1.19 UTILITIES
27

- 28 A. It shall be the responsibility of the Contractor to provide all temporary connection and cables,
29 lighting, light stands and power. The facilities shall be used in accordance with all applicable
30 regulations regarding operations, safety and fire hazards of the governmental Authorities
31 Having Jurisdiction, provided they are not used in a wasteful manner.
32

33 1.20 PERMITS
34

- 35 A. All permits required for the specified performance and completion of the work shall be
36 secured by the Contractor. These permits shall be presented and reviewed at the initial project
37 progress meeting.
38

39 1.21 NOTIFICATION
40

- 41 A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at
42 least ten (10) calendar day's notice of any requirements to shut off or interference with
43 existing alarm, regulating, computer or other service systems. The Owner will arrange and
44 execute any shutdown. All work such as splicing, connections, etc., necessary to establish or
45 re-establish any system shall be completed by the Contractor in close coordination with the
46 Owner.
47

48 1.22 INTERFERENCES WITH THE OWNER
49

- 50 A. Transportation and storage of materials at the facility, work involving the facility, and all
51 other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as
52 to cause the least possible interference, and at times and in a manner acceptable to the Owner.
53 The Contractor shall make every effort to delivery equipment per the schedule required by the
54 project.
55

1.23 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2012 / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2012 dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
 3. Three sets of blue or black-line prints of each contract as-built drawing.
- C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
 2. Remove Engineer's Seal, name, address, and logo from drawings.
 3. Mark documents AS-BUILT DRAWINGS.
 4. Clearly indicate: DOCUMENT PRODUCED BY:
 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
 6. Indicate exact location of all underground ESS raceways, and elevations.
 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
 9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
 10. Exact location of all ESS equipment in and outside of the building.
 11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
 13. Cloud all changes.

1.24 OPERATING TESTS

- A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.25 WARRANTY

- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of

substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED:

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

- 1
2 C. Install, make fully operational and test the system as indicated on the Drawings and in the
3 Specifications. Where information is not available the worst-case condition must be assumed
4 to ensure a complete, functional system.
5
6 D. Any interfacing with other systems shall be the Contractor's responsibility under this contract,
7 and the details, both logical and physical, of such interfaces shall be reflected in the
8 Submittals and As-Built drawings.
9
10 E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System
11 shall be coordinated with the Owner and Architect.
12
13 F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and
14 wire shall be furnished and installed to provide a complete and reliable system. Exact location
15 of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect
16 for approval in advance of any installation. Provide as required and as specified in Division
17 26.
18
19 G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a
20 junction box, to the system devices. Provide as required and as specified in Division 26.
21
22 H. Where required, install conduit, cable and wire parallel and square with building lines,
23 including raised floor areas. Conduit fills shall not exceed 40%.
24
25 I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all
26 applicable codes and facilitate observation and testing. Securely hand and/or fasten with
27 appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire
28 system. Units shall be installed parallel and square to building lines.
29
30 J. Quiet and vibration-free operation of all equipment is a requirement of this installation.
31 Properly adjust, repair, balance or replace any equipment producing objectionable (in the
32 judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any
33 building and provide additional brackets and bracing if necessary. Any such additions or
34 changes shall be at no additional cost to the Owner.
35
36 K. Installation shall comply with the CODES AND STANDARDS portion of this Section.
37 Where more than one code or regulation if applicable, the more stringent shall apply.
38
39 L. Where new equipment is replacing old equipment, the Contractor is responsible for removing
40 and disposing of the old equipment and doing whatever repair work is necessary as specified
41 by the Owner / Architect.
42
43 M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to
44 meet code at the completion of work and prior to final testing demonstration to the Owner.
45
46 N. The installation shall be performed in a professional manner.
47
48 O. On a daily basis, clean up and deposit in appropriate containers all debris from work
49 performed under the appropriate specification sections. Stack and organize all parts, tools and
50 equipment when not being used.
51
52 P. Preparation, handling and installation shall be in accordance with the Manufacturer's written
53 instructions and technical data appropriate to the product specified.
54
55 Q. All work shall conform to the National Electrical Contractor's Association "Standard of
56 Installation" for general installation practice.

ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

- R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

- 1 I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks
2 or D-rings to hold cables. Provide independent support for all cables. Support is to be from
3 building structure (do not support from pipes or conduits). ESS cables shall not tie off on
4 HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.
5
- 6 J. Ground and bond equipment and circuits in accordance with NEC and Division 26.
7
- 8 3.5 IDENTIFICATION AND TAGGING
9
- 10 A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels,
11 tags to other permanent markings in accordance with TIA/EIA-606. The markings shall
12 clearly indicate the function, source, or destination of all cabling, wiring and terminals. All
13 cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire
14 markers (Brady Type B-32 *or equal*). Hand written tags are not acceptable.
15
- 16 B. Should a situation arise where the wire tagging format as shown on the drawings cannot be
17 used, a substitute format shall be submitted which complies with the intent to provide
18 documentation that will permit end-to-end tracing of all ESS Systems wiring.
19
- 20 C. All panels shall be provided with permanently attached engraved lamacoid labels with
21 identifying names and functions. All terminal points shall be appropriately labeled. Labels
22 shall be consistent in form, color, and typeface throughout the system and all must contain the
23 name of the system or subsystem as part of the label textual information. Design, color, font
24 and layout shall be coordinated with, and approved by, the Owner.
25
- 26 D. Identification of Equipment:
27 1. All major equipment shall have a manufacturer's label identifying the manufacturer's
28 address, equipment model and serial numbers, equipment size, and other pertinent
29 data. Take care not to obliterate this nameplate. The legend on all nameplates or tags
30 shall correspond to the identification shown on the Operating Instructions.
31 2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall
32 be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
33 a. Identifying nameplates shall have 1/2-inch high, engraved letters.
34 3. Permanent, waterproof, black markers shall be used to identify each ESS grid
35 junction box, clearly indicating the type of system available at that junction box.
36 4. Pull Boxes: Field work each with a nameplate showing identity, and identifying
37 equipment connected to it. Nameplates shall also indicate where pull box is fed from.
38
- 39 E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source
40 from whom the material has been obtained are prohibited for installation in public, tenant, or
41 common areas within the project. Also prohibited are materials or devices that bear evidence
42 that markings or insignias have been removed. Certification, testing (example, Underwriters
43 Laboratories), and approval labels are exceptions to this requirement.
44
- 45 F. Warning Signs: Provide warning signs where there is hazardous exposure associated with
46 access to or operation of ESS facilities. Provide text of sufficient size to convey adequate
47 information at each location; mount permanently in an appropriate and effective location.
48 Comply with industry standards for color and design.
49
- 50 G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes,
51 gutters, wireways. Identify with drop/circuit number.
52
- 53 H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape,
54 colored red or orange with suitable warning legend describing buried ESS lines. All
55 underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below

grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
 - 1. Provide the training during regular working day.
 - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
- B. Time to be allocated for instructions.
 - 1. Minimum of 12 hours dedicated instructor time
 - 2. 4 hours on each of 3 days
 - 3. Additional instruction time for specific systems as specified in other Sections.
- C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
 - 1. One copy to the Owner
 - 2. One copy to the Architect / Engineer
- D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

1 3.8 OPENINGS

- 2
3 A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other
4 divisions. Drawings and layout work for exact size and location of all openings are included
5 under this division.
6

7 3.9 HOUSEKEEPING PADS

- 8
9 A. Provide concrete equipment housekeeping pads under outdoor mounted ESS equipment.
10
11 B. Concrete and reinforcing steel shall be as specified in Division 03, or as indicated or noted.
12
13 C. Concrete pads:
14 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or as indicated
15 on the drawings or in other sections of the specifications.
16 2. Chamfer strips at edges and corner of forms.
17 3. Smooth steel trowel finish.
18 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise
19 shown.
20 5. 6-inch x 6-inch #8 wire reinforcement mesh.
21

22 3.10 OBSTRUCTIONS

- 23
24 A. The drawings indicate certain information pertaining to surface and subsurface obstructions,
25 which has been taken from available drawings. Such information is not guaranteed, however,
26 as to accuracy of location or complete information.
27 1. Before any cutting or trenching operations are begun, verify with Owner's
28 representative, utility companies, municipalities, and other interested parties that all
29 available information has been provided.
30 2. Should obstruction be encountered, whether shown or not, alter routing of new work,
31 reroute existing lines, remove obstruction where permitted, or otherwise perform
32 whatever work is necessary to satisfy the purpose of the new work and leave existing
33 services and structures in a satisfactory and serviceable condition.
34
35 B. Assume total responsibility for and repair any damage to existing utilities or construction,
36 whether or not such existing facilities are shown.
37

38 3.11 VANDAL RESISTANT DEVICES

- 39
40 A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2
41 suitable tools for use with each type of fastener used.
42
43 B. Proof of delivery of these items to the Owner shall be included in the Operating and
44 Maintenance Manuals.
45

46 3.12 PROTECTION

- 47
48 A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean
49 and in original manufacturer's condition.
50
51 B. Do not deliver equipment to this project site until progress of construction has reached the
52 stage where equipment is actually needed or until building is closed in enough to protect the
53 equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the
54 contractor is obligated to furnish new equipment of a like kind at no additional cost to the
55 Owner.
56

1 3.13 EQUIPMENT BACKBOARDS

- 2
3 A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
4 1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
5 2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.
6

7 3.14 SITE MANAGEMENT RESPONSIBILITY

- 8
9 A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF
10 WORK portion of this Section.
11

12 3.15 START-UP RESPONSIBILITY

- 13
14 A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-
15 Up personnel on each consecutive working day until all ESS Systems are functional and ready
16 to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is
17 not demonstrating progress in solving any technical problems, the Contractor shall supply
18 Manufacturer's factory technical representation and diagnostic equipment at no cost to the
19 Owner, until resolution of those defined problems. Where appropriate, the Contractor shall
20 bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access
21 control, etc.) It is the responsibility of the Owner to provide the specific database information
22 that will be utilized for initial system programming.
23
24 B. Properly ground each piece of electronic equipment prior to applying power. Properly ground
25 all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote
26 or device end.
27
28 C. Use a start-up sequence that incrementally brings each portion of the system on-line in a
29 logical order that incorporates checking individual elements before proceeding to subsequent
30 elements until the entire system is operational. The basic steps should include:
31 1. Establish ground planes at the equipment rooms and hub end of the systems as
32 specified in Division 26.
33 2. Disconnect power, connect the first device, reconnect power, and verify operational
34 correctness. Repeat until the entire system is verified and operational.
35

36 3.16 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- 37
38 A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and
39 properly labeled and identified.
40
41 B. All materials shall be neat, clean and unmarred, and parts securely attached.
42
43 C. All extra material as specified shall be delivered and stored at the premises as directed.
44
45 D. Test reports of each system and each system's components and As-Built Project Drawings
46 shall be complete and available for inspection and delivery as directed by the Owner.
47

48 3.17 SYSTEM ACCEPTANCE REQUIREMENTS

- 49
50 A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the
51 following in the order stated.
52
53 B. The Contractor shall deliver three (3) composite "System Operations and Maintenance"
54 manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each
55 manual shall contain in appropriately tabbed sections:

1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:

1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:

1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.

1. System Operations and Maintenance Manuals
2. System Test Reports
3. As-Built Drawings

3.18 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

SECTION 28 05 05

ELECTRONIC SAFETY AND SECURITY ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There exists the possibility that there are existing conditions and devices which are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to take these existing conditions into consideration when making and presenting a proposal to as to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.

ELECTRONIC SAFETY AND SECURITY ALTERATIONS PROJECT PROCEDURES

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54

- D. Verify that abandoned wiring and equipment serve only abandoned facilities.
- E. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect before disturbing existing installation.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- C. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- D. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- E. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- F. Clean and repair existing materials and equipment that remain or are to be reused.

3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Architect and Owner.
- B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- C. Remove and replace existing conduit, wiring, outlets, devices, and appurtenances as occasioned by new or remodeled construction. Re-establish service to devices that may be interrupted by remodeled construction.
- D. Disconnect communication systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
 - 1. Remove exposed conduit that has been abandoned.
 - 2. Cap conduit beyond the finish line.
- E. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect/Owner for salvage by Owner.
- F. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

- 1 G. Existing Security System: Maintain existing system in service. Disable system only to
2 make switchovers and connections. Notify the Owner at least 24 hours before partially or
3 completely disabling system. Minimize outage duration.
4
- 5 H. Existing Video Surveillance System: Maintain existing system in service. Disable
6 system only to make switchovers and connections. Notify the Owner at least 24 hours
7 before partially or completely disabling system. Minimize outage duration.
8
- 9 3.4 DEMOLITION AND EXTENSION OF EXISTING SAFETY AND SECURITY WORK
10
- 11 A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated
12 on the drawings or required by the installation of new facilities. All removals and/or
13 dismantling shall be conducted in a manner as to produce maximum salvage. Salvage
14 materials shall remain the property of the Owner, and shall be delivered to such
15 destination as directed by the Owner's representative unless they are not wanted, then it
16 will be the responsibility of this Contractor to remove such items and properly dispose of
17 them. Materials and/or items scheduled for relocation and which are damaged during
18 dismantling or reassembly operations shall be repaired and restored to good operative
19 condition. The Contractor may, at his discretion, and upon approval of the Owner's
20 representative substitute new materials and/or items of like design and quality in lieu of
21 materials and/or items to be relocated.
22
- 23 B. All items to be relocated shall be carefully removed in reverse to original assembly or
24 placement and protected until relocated. The Contractor shall clean and repair and
25 provide all new materials, fittings, and appurtenances required to complete the
26 relocations and to restore them to good operative order. All relocations shall be
27 performed by workmen skilled in the work and in accordance with standard practice of
28 the trades involved.
29
- 30 C. When items scheduled for relocation and/or reuse are found to be in damaged condition
31 before work has been started on dismantling, the Contractor shall call the attention of the
32 Owner's representative to such items and receive further instructions before removal.
33 Items damaged in repositioning operations are the contractor's responsibility and shall be
34 repaired or replaced by the contractor as approved by the owner's representative, at no
35 additional cost to the Owner.
36
- 37 D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to
38 points indicated on the drawings, specified, or acceptable to the Owner's representative.
39 Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse
40 is to be continued or service is to remain. Such services shall be sealed, capped, or
41 otherwise tied-off or disconnected in a safe manner acceptable to the Construction
42 Inspector. All disconnections or connections into the existing facilities shall be done in
43 such a manner as to result in minimum interruption of services to adjacent occupied
44 areas. Services to existing areas or facilities that must remain in operation during the
45 construction period shall not be interrupted without prior specific approval of the
46 Owner's representative hereinbefore specified.
47
- 48 E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit
49 servicing them is abandoned and removed. Provide blank cover for abandoned outlets
50 that are not removed.
51
- 52 F. Disconnect and remove communication devices and equipment serving utilization
53 equipment that has been removed.
54
- 55 G. Repair adjacent construction and finishes damaged during demolition and extension
56 work.

H. Maintain access to existing communication installations that remain active. Modify installation or provide access panel as appropriate.

I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.5 PROTECTION OF THE WORK

A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.

B. Provide devices and methods to protect other portions of work from damage.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Repairs, equipment replacements, and corrections to special systems due to damage caused by contractor:

1. For each special system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
2. Corrective measures to the special systems to correct components of the special systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect prior to acceptance of substantial completion at no additional cost to the Owner.

3.6 TESTING AND CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

A. Pre-construction testing of existing low voltage systems:

1. Provide a complete operational test of the following systems prior to demolition and renovation. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be preformed by a contractor and technicians, each certified by the respective manufacturer of the existing special system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
 - a. Security Access Control System
 - b. Video Surveillance System
 - c. Fire Alarm and Detection System
2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and individuals performing the tests. Provide the written report within 14 days of notice to proceed and prior to any demolition or renovation work.

B. Substantial completion testing of existing special systems:

1. Provide complete operational test of the following systems within 14-days prior to estimated date of substantial completion. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be preformed by a contractor and technicians each certified by the respective manufacturer of the existing system to perform test, programming,

1 and repairs to the respective manufacturer's system. Testing of the existing
2 system shall include all areas served by the existing system including but not
3 limited to the main campus, remote buildings, and temporary buildings:

- 4 a. Security Access Control System
- 5 b. Video Surveillance System
- 6 c. Fire Alarm and Detection System

- 7 2. Provide a complete written report to the Architect, indicating any deficiencies of
8 the existing system in relation to each component's intended function. Include in
9 the written report evidence of current certification by the respective
10 manufacturer for the contractor and each individual performing the tests.
11 Provide the written report within 14 days of expected date for substantial
12 completion.
13

14 END OF SECTION

SECTION 28 05 07

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
 - 1. Shop Drawings
 - 2. Coordination Drawings
 - 3. Product data
- D. Submittals shall be prepared and produced for:
 - 1. Distribution as specified
 - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
 - 1. Actual ESS equipment and components to be furnished.
 - 2. NEC working space and NEC access to NEC working space.
 - 3. Relationship to other equipment and components and openings, doors and obstructions
 - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of ESS station devices and other work specified in this Division.

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.
- 1.4 PRODUCT DATA
- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
 - B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
 - C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
 - D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
 - E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)
- 1.5 MANUFACTURERS INSTRUCTIONS
- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.
- 1.6 CONTRACTOR RESPONSIBILITIES
- A. Review submittals prior to transmittal.
 - B. Determine and verify:
 1. Field measurements
 2. Field construction criteria
 3. Manufacturer's catalog numbers
 4. Conformance with requirements of Contract Documents
 - C. Coordinate submittals with requirements of the work and of the Contract Documents.
 - D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
 - E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
 - F. Contractor's responsibility for errors and omissions in submittals is not relieved whether

- 1 Architect / Engineer reviews submittals or not.
- 2
- 3 G. Contractor's responsibility for deviations in submittals from requirements of Contract
- 4 Documents is not relieved whether Architect / Engineer reviews submittals or not, unless
- 5 Architect / Engineer gives written acceptance of the specific deviations on reviewed
- 6 documents.
- 7
- 8 H. Submittals shall show sufficient data to indicate complete compliance with Contract
- 9 Documents:
- 10 1. Proper sizes and capacities
- 11 2. That the item will fit in the available space in a manner that will allow proper service
- 12 3. Construction methods, materials and finishes
- 13
- 14 I. Schedule submissions at least 15 days before date reviewed submittals will be needed.
- 15
- 16 1.7 SUBMISSION REQUIREMENTS
- 17
- 18 A. Make submittals promptly in accordance with approved schedule, and in such sequence as to
- 19 cause no delay in the Project or in the work of any other Contractor.
- 20
- 21 B. Number of submittals required:
- 22 1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
- 23 2. Product Data: Submit the number of copies the contractor requires, plus those to be
- 24 retained by the Architect / Engineer.
- 25
- 26 C. Accompany submittals with transmittal letter, in duplicate, containing:
- 27 1. Date
- 28 2. Project title and number
- 29 3. Contractor's name, address and telephone number
- 30 4. The number of each Shop Drawing, Project Datum and Sample submitted
- 31 5. Other pertinent data
- 32
- 33 D. Submittals shall include:
- 34 1. The date of submission
- 35 2. The project title and number
- 36 3. Contract Identification
- 37 4. The names of:
- 38 a. Contractor
- 39 b. Subcontractor
- 40 c. Supplier
- 41 d. Manufacturer
- 42 5. Identification of the product
- 43 6. Field dimensions, clearly identified as such
- 44 7. Relation to adjacent or critical features of the work or materials
- 45 8. Applicable standards, such as ASTM or federal specifications numbers
- 46 9. Identification of deviations from contract documents
- 47 10. Suitable blank space for General Contractor and Architect / Engineer stamps
- 48 11. Contractor's signed and dated Stamp of Approval
- 49
- 50 E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
- 51 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
- 52 2. Associated items requiring correlation for efficient function or for installation
- 53
- 54 1.8 SUBMITTAL SPECIFICATION INFORMATION
- 55
- 56 A. Every submittal document shall bear the following information as used in the project manual:

1. The related specification section number
 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.
- 1.9 RESUBMISSION REQUIREMENTS
- A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.
- 1.10 CONTRACTOR'S STAMP OF APPROVAL
- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.
- 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS
- A. The Architect / Engineer will:
1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

1
2 D. The review and approval of a separate item as such will not indicate approval of the assembly
3 in which the item functions.
4
5 1.12 SUBSTITUTIONS
6
7 A. Do not make requests for substitution employing the procedures of this Section.
8
9 B. The procedure for making a formal request for substitution is specified in Division 01.
10
11 PART 2 - PRODUCTS - NOT USED.
12
13 PART 3 - EXECUTION
14
15 3.1 SHOP DRAWINGS AND PRODUCT DATA
16
17 A. Submittals shall not be combined or bound together with any other material submittal.
18
19 B. Submit individually bound shop drawings and product data for the following when specified
20 or provided:
21 1. Low Voltage Wire
22 2. Electronic Access Control and Intrusion Detection
23 3. Electronic Surveillance
24 4. Fire Detection and Alarm
25
26 3.2 COORDINATION DRAWINGS
27
28 A. Submit coordination drawings as specified.
29
30 END OF SECTION

SECTION 28 05 10

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
 - 1. Field conditions.
 - 2. Condition of installation.
 - 3. Quality of workmanship.
 - 4. Start-up of equipment.
 - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

CONTRACT QUALITY CONTROL

1 1.7 MOCK UPS

- 2
- 3 A. Assemble and erect the specified equipment and products complete, with specified
- 4 anchorage and support devices, seals and finishes.
- 5
- 6 B. Do not proceed with any work involving a mock-up, until the related mock up has been
- 7 approved in writing.
- 8
- 9 C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- 10
- 11 D. Perform tests and submit results as specified.
- 12

13 1.8 SCHEDULING OF MOCK-UPS

- 14
- 15 A. Schedule demonstration and observation of mock-ups, in phases, with Architect /
- 16 Engineer.
- 17 1. Rough-in
- 18 2. Finish with all appurtenances in place
- 19 3. Demonstrations
- 20

21 PART 2 - PRODUCTS

22

23 2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

24

25 PART 3 - EXECUTION

26

27 3.1 ADJUSTMENTS AND MODIFICATIONS

28

- 29 A. Contractor shall provide all adjustments and modifications as requested by the
- 30 manufacturer's qualified personnel at no additional cost to Owner.
- 31

32 3.2 MOCK-UPS

- 33
- 34 A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring
- 35 devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all
- 36 wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.
- 37

38 END OF SECTION

SECTION 28 10 00

ELECTRONIC ACCESS CONTROL SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The contractor shall furnish and install a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, signal initiating and signaling devices, door hardware, conduit, wire, fittings, labor and all other accessories required to provide a fully functioning system.

1.2 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

- A. National Fire Protection Association Standards:
1. NFPA 70 National Electric Code
 2. NFPA 72 National Fire Alarm Code
 3. NFPA 101 Life Safety Code
- B. Local & State Building Codes
- C. Requirements of Local Authorities having Jurisdiction
- D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.
- E. Requirements of American Disabilities Act (Public law 101-336).
- F. Texas Accessibility Standards (T.A.S.)
- G. State Fire Marshall.
- H. Texas Insurance Code.

1.3 RELATED WORK

- A. Division 08 - Door Hardware

1.4 DEFINITIONS

- A. ACS – Access Control System
- B. CSA – Client Software Application
- C. DGM – Dynamic Graphical Maps
- D. ALPR – License Plate Recognition
- E. SDK – Software Development Kit
- F. SMA – Software Maintenance Agreement
- G. SSM – Server Software Module
- H. UI – User Interface
- I. USP – Unified Security Platform
- J. USW – Unified Web Client
- K. VMS – Video Management System
- L. DVS – Digital Video Server

1 1.5 QUALITY ASSURANCE

2
3 A. Contractor Qualifications:

- 4 1. The installing contractor shall be the authorized representative of the access control
5 system manufacturer to sell, install, and service the proposed manufacturer's
6 equipment. The installing contractor shall have represented the security alarm
7 manufacturer's product for at least two years.
8 2. The installing contractor shall be licensed by the State of Texas as a security services
9 contractor to design, sell, install, and service security alarm systems.
10 3. The installing contractor shall provide 24 hour, 365 day per year emergency service
11 with factory trained service technicians.
12 4. The installing contractor shall have personnel on their staff that has been actively
13 engaged in the business of designing, selling, installing, and servicing security alarm
14 systems for at least ten (10) years.

15
16 B. The system programmer shall have attended manufacturer training and obtained certification
17 in OpenOptions.

18
19 C. Optionally, the system programmer shall have attended manufacturer training and obtained
20 certification in OpenOptions.

21
22 D. The system programmer shall be a OpenOptions certified partner.

23
24 E. All Contractors shall submit to the Owner prior to starting any work the factory training
25 certificates for all personnel that will be working on the access control system. No person is
26 allowed to work on the system without proper manufacturer's certification.
27

28 1.6 SUBMITTALS

29
30 A. The installing contractor and/or equipment supplier shall provide complete and detailed shop
31 drawings and include:

- 32 1. Control panel wiring and interconnection schematics.
33 2. Complete point to point wiring diagrams.
34 3. Riser diagrams.
35 4. Complete floor plan drawings locating all system devices.
36 5. Factory data sheets on each piece of equipment proposed.
37 6. Detailed system operational description. Any specification differences and deviations
38 shall be clearly noted and marked.
39 7. Complete system bill of material.
40 8. Line by line specification review stating compliance or deviation.
41

42 B. All submittal data will be in bound form with Contractor's name, supplier's name, project name,
43 and state security license number adequately identified.
44

45 PART 2 – PRODUCTS

46
47 2.1 ACCEPTABLE MANUFACTURERS

48
49 A. Head-End/Software

- 50 1. DNA Fusion by OpenOptions
51

52 B. Controllers

- 53 1. Mercury

- 1 C. Card Readers
- 2 1. Schlage
- 3
- 4 D. Wiring
- 5 1. Belden
- 6 2. Tappan Wire and Cable
- 7 3. Approved Equal
- 8
- 9 E. Access Control Panel
- 10 1. STI
- 11 2. Altronix
- 12
- 13 F. Door Position Switches
- 14 1. Interlogix
- 15 2. GE
- 16 3. GRI
- 17
- 18 G. Accessories
- 19 1. Schlage
- 20 2. STI
- 21 3. AiPhone
- 22
- 23 2.2 PERFORMANCE REQUIREMENTS
- 24
- 25 A. Controllers:
- 26 1. SIO Boards
- 27 a. Mercury MR16IN-S3
- 28 b. Mercury MR16OUT-S3
- 29 2. Downstream Controller (door controller):
- 30 a. Mercury MUX8
- 31
- 32 B. Card Readers
- 33 1. Multi-Class
- 34 2. 50/75mA @ 12VDC
- 35 3. Wiegand interface
- 36 4. Wall mounted: MT15
- 37 5. Mullion Mounted: MT11
- 38 6. Integrated Reader: AD300
- 39
- 40 C. Wiring
- 41 1. Plenum rated
- 42 2. Shall be yellow
- 43 3. Belden 658AFJ or approved equal
- 44
- 45 D. Access Control Panel
- 46 1. Minimum of NEMA 1
- 47 2. Shall be lockable
- 48 3. Color to be coordinated prior to purchase
- 49 4. Shall be STI-EM111504 or approved equal.
- 50
- 51 E. Door Position Switches
- 52 1. Shall be double pole, double throw
- 53 2. Shall be Interlogix 1076D-N or approved equal

F. Accessories

1. Credentials shall be Schlage 7610T keyfob
2. Lockdown button shall be STI SS2242LD-EN
3. AiPhone shall be JO Series master station and door station.

PART 3 - EXECUTION

3.1 GENERAL

- A. The contractor shall have furnished and installed a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power circuits, signal initiating and signaling devices, door hardware, conduit, wire, fittings, labor and all other accessories required to provide a fully functioning system.

3.2 HARDWARE INSTALLATION

A. General

1. Provide mock-up of a typical entry door, complete with conduit, outlet boxes, cables and access control devices prior to installation.
2. All security conduit as required for a complete installation of this system shall be provided as specified in Division 26.
3. Coordination with the Division 26 is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.

B. Wiring/Conduit

1. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
2. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
3. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
4. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
5. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
6. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
7. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.
8. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.

9. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.
10. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated j-hook style cable support system for the entire run of each cable. Including, but not limited to service loops.
11. The cable support system shall be attached directly to the building steel at a serviceable height. If the building steel is not within 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the support hook to the treaded rod.

C. System

1. Furnish and install one (1) card reader for each location shown on drawings. Provide and install all necessary components; inclusive of electrified hardware, as specified in Division 8, power transfers, and card readers, at all locations as shown on drawings.
2. Provide and install an additional access control panel in each room where existing panel is, complete with all downstream panels, SIO boards and licensing as necessary. Provide all mounting accessories as necessary for mounting of all boards within provided access control panel. All new MUX8 panels shall attached to SSP-EP within the space, provide amount of 2" conduit necessary, to facilitate cabling between existing and new access control panel.
3. Provide and install all door position switches, that shall route back to an SIO board, and be integrated into the existing OpenOptions system.
4. Provide and install power supplies as necessary for complete powering of all provided devices, to mount within provided access control panel.
5. Provide and install request to exit switches in all newly installed card access location, integrate into OpenOptions system.
6. Provide and install lock down buttons in all locations as shown, integrate into OpenOptions system.
7. Provide and install quantity of 500 7610T fobs, number to be coordinated with Owner's personnel prior to purchase.
8. Provide and install AiPhone at all locations shown on drawings, provide both master and door station. Provide all necessary relays for integration into the door hardware.
9. Provide all programming time necessary to integrate all provided hardware and cabling into Owner's existing OpenOptions system. Provide an addition 16-hours, on two different days, of programming time for Owner requested changes.

3.3 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report shall be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

- A. Contractor shall provide minimum of one (1) year warranty of workmanship and product. Must support (24) hour turn time to fix and/or replace any system issues or hardware
- B. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in

1 materials and workmanship under normal use. Software defects are covered through Service
2 Releases and Cumulative Updates which are available for a period of 1 year from the date of
3 substantial completion
4

5 END OF SECTION

SECTION 28 20 00

VIDEO SURVEILLANCE SYSTEM (VSS)

PART 1 – GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
1. Conditions of the Contract
 2. Division 1
 3. Division 26
 4. Division 27
 5. Division 28

1.2 GENERAL PRODUCT REQUIREMENTS

- A. The software used shall be designed for enterprise level use, with an expected use period of 24/7. It shall be the Manufacturer's official software.
- B. The software shall incorporate open standards and published protocols and use standardized components.
- C. The Video Management System provider shall be defined as the provider of the video management software, and the party responsible for rigorous self-testing of the video management software prior to the release of the software.

1.3 GENERAL SYSTEM DESCRIPTION

- A. The Video Management System shall support both centralized and decentralized configurations as well as hybrid options for architecture. Centralized management shall be available no matter the surveillance architecture. The system shall allow for integration with other security devices and products and be designed to allow for leveraging of those products to improve the user experience of the VMS.
- B. The VMS shall not require a central management server.
- C. The VMS shall make the user experience seamless to the end user irrespective of the system architecture.
- D. The VMS must be capable of each server being able to handle an unlimited number of cameras for recording.
- E. The VMS must support Windows Server 2008, 2012, and Windows Server 2016 for the server side. Client- side software must be available for Windows 7, 8 and 10, Mac OSX, iOS 6 and above, and Android. The operating system shall have all current and available patches.
- F. The VMS shall include the following without additional license fees:
1. Client software for Windows.
 2. Client software for Mac OSX.
 3. Client software for iOS 6 and above.
 4. Client software for Android-based platforms.
 5. Client software using a web-based interface.
 6. Standalone clients designed to provide fixed displays.
 7. Video Wall functionality.

VIDEO SURVEILLANCE SYSTEM (VSS)

8. SmartSearch.
9. Access Control Integration.
10. Full Access Control software platform.
11. Failover server functionality.
12. A separate health monitor application.

G. The VMS shall not require a separate application for administration and user-based roles. Limitations for non-administrative users shall be handled via permissions.

H. The system shall support running in Virtual Servers for both the server application and client applications

1.4 SECTION INCLUDES

A. Video Management Systems:

1. Server application.
2. Desktop application.
3. Mobile application.

B. Servers:

1. Rackmount.
 - a. Servers will be provided, installed, and programmed by the system installer.
 - b. Server sizes and quantities shall be based on the needs to meet the requirements established by, but not limited to the following:
 - 1) Bandwidth
 - 2) Camera resolution
 - 3) Client workstation access
 - 4) Frame rates
 - 5) Video Compression
 - 6) Motion based recording
 - 7) Maximum of sixty-four (64) views per server
 - 8) Days of Retention
 - c. Provide a minimum of one server per site

C. IP security cameras.

D. VMS software licenses.

E. Encoders and decoders.

F. Controller systems.

G. Accessory products.

1.5 REFERENCES

A. Code of Federal Regulations (CFR).

B. Institute of Electrical and Electronics Engineers (IEEE):

1. 802.3 Ethernet Standards.

C. International Electrotechnical Commission (IEC).

D. International Organization for Standardization (ISO):

1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
 3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).
- E. Federal Communications Commission (FCC):
 1. FCC Rules and Regulation of Title 47 of CFR Part 15 Subpart B Class A.
 - F. Open Network Video Interface Forum (ONVIF):
 1. ONVIF - Profiles S Specification.
 - G. Underwriters Laboratories (UL):
 1. UL listed.
- 1.6 DEFINITIONS
- A. Abbreviations:
 1. ARP - Address Resolution Protocol.
 2. DHCP - Dynamic Host Configuration Protocol.
 3. DNR - Digital Noise Reduction.
 4. DDNS - Dynamic Domain Name Server.
 5. FPS - Frames Per Second.
 6. GUI - Graphical User Interface.
 7. HDD - Hard Disk Drive.
 8. HTTP - Hypertext Transfer Protocol.
 9. ICMP - Internet Control Message Protocol.
 10. IGMP - Internet Group Management Protocol
 11. IP - Internet Protocol.
 12. iSCSI - Internet Small Computer System Interface.
 13. JBOD - Just a Bunch of Disks.
 14. JPEG - Joint Photographic Experts Group.
 15. MJPEG - Motion JPEG.
 16. MP - Megapixel.
 17. MPEG - Moving Pictures Experts Group.
 18. NAS - Network Attached Storage.
 19. NTP - Network Time Protocol.
 20. POS - Point of Sale.
 21. PPPoE - Pont to Point Protocol over Ethernet.
 22. RAID - Redundant Array of Independent Disks (Drives).
 23. RTP - Real-Time Transport Protocol.
 24. RTCP - Real-Time Control Protocol.
 25. RTSP - Real-Time Streaming Protocol.
 26. SMTP - Simple Mail Transfer Protocol.
 27. SNMP - Simple Network Management Protocol.
 28. SSL - Secure Sockets Layer.
 29. TCP - Transmission Control Protocol.
 30. UDP - User Datagram Protocol.
 31. UPnP - Universal Plug and Play.
 32. VMS - Video Management System.
 33. PoS - Point of Sales.
 34. VA - Video Analytics.
 35. PnP - Plug and Play.
 36. ARB - Auto Recovery Backup.
 37. NVR - Network Video Recorder.
 38. RAID - Redundant Array of Independent Disks.

- 1
2 B. Definitions:
3 1. JBOD: A collection of hard disks that have not been configured to act as a
4 redundant array of independent disks (RAID) array.
5 2. GOV (Group of Video object planes): A set of video frames for H.264 and H.265
6 compression, indicating a collection of frames from the initial I-Frame (key frame) to
7 the next I-Frame. GOV consists of 2 kinds of frames: I-Frame and P-Frame.
8 3. Dynamic GOV: Dynamic assignment of GOV length based on the complexity of the
9 scene to efficiently manage bitrate of the video stream and reduce the storage
10 required.
11 4. Dynamic fps: Dynamic assignment of frames per second based on the complexity of
12 the scene to efficiently manage bitrate of the video stream and reduce the storage
13 required.
14 5. ARB (Auto Recovery Backup): Automatic backup mechanism that enables cameras
15 to store videos on to SD card during failures and stream it to the storage device after
16 recovery.
17 6. Failover: A feature that automatically switches to a redundant or standby device
18 upon failure or unexpected shutdown of an active device.
19
20 1.7 SUBMITTALS
21
22 A. Project Initiation:
23 1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall
24 furnish the following in a single consolidated submittal:
25 a. Permits: The Contractor shall obtain all required permits and provide copies
26 to the Owner / Architect / Engineer.
27 b. Product Literature: Complete manufacturer's product literature for all
28 material, hardware, and equipment to be used in the installation of the
29 specified system. In addition, whenever substitutions for recommended
30 products are made, samples (when requested by the Owner / Designer) and
31 the manufacturer's supporting documentation demonstrating compatibility
32 with other related products shall be included. The submittal shall have some
33 type of distinguishing marker or pointer to indicated what specific product is
34 to be provided
35 c. Construction Schedule: A time-scaled Construction Schedule, indicating
36 general project deadlines and specific dates relating to the installation of the
37 cable distribution system.
38 d. Specification Compliance: A letter shall be provided stating, by section and
39 subsection, that the SCS installer complies with the entire specification
40 section. If the installer intends to deviate from any portion of the
41 specifications, a detailed explanation of reason in which the installer would
42 like to deviate shall be provided in addition to the specification compliance
43 letter. No deviations shall be acceptable until they have been approved by the
44 Owner.
45 e. Each Submittal must have a detailed parts list. Quantities will not be required
46 as the quantity of any portion of this system shall be as required for a
47 complete and functional system and in conjunction with the contract
48 documents.
49 f. Certifications: The contractor shall submit all certifications for approved
50 products and the certifications must contain dates which are valid from the
51 date of proposal and not expirer any sooner than 12 months after substantial
52 completion of the project.
53 1) Physical Security Professional (PSP) Certification: This
54 certification must be held by an on-staff, full-time employee of the
55 system installer. The holder must be staffed out of the office that is
56 located within 75 miles of the projected.

- 2) Manufacturer Authorized Dealer Certification must be held by the system installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
- 3) Installer Certifications: Certification indicating that an individual has successfully completed installer training, issued by the VMS and Cameras Manufacturers specified herein, must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - a. Proposed cable routing and grouping plan.
 - b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - 1) Location of sleeved wall and floor pass-thru
 - 2) Size of sleeve at each location installed
 - 3) Quantity of cable passing through each sleeve
 - 4) Location of devices and head end equipment.
 - 6) Conduit routing, size, and quantity
 - c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 - d. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.

C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.

D. Close-out Procedures:

1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
 - a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 - b. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - c. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
 - d. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 - e. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure

cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.

- f. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
- g. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
- h. A copy of the manufacturer's warranty on the installed system.
- i. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
- j. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
- k. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.
- B. System Integrator shall provide the following as part of the System Solution:
 - 1. Complete product and technical data specification sheets that include all material and equipment and shall be available freely online.
 - 2. List of all equipment with part numbers, manufacturer, firmware, and assigned IP addresses.
 - 3. Locations and details for all components to be installed under this scope of work.
 - 4. Placement Diagram showing the proposed location of all system hardware devices.
 - 5. System Calculation of all network bandwidth and storage requirements for System Servers to ensure proper planning of computing and networking infrastructure.
- C. Installer Qualifications: Minimum 10-year experience installing similar products. Installers shall be trained and authorized by the Manufacturer to install, integrate, test, and commission the system.

1.9 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.11 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.12 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.13 WARRANTY

- A. The security system VMS software and labor furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance of the Video Surveillance System.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.
- C. Software Licensing and Warranty:
1. Software licensing should be on a per device basis (e.g. 1 x license for 1 IP Camera or I/O device) with no base license for additional features or capabilities.
 2. The VMS Software should be completely free for live streaming or playback of offline media files (images, videos).
 3. Lifetime software upgrades shall be provided by the Manufacturer without cost and without the need for an annual maintenance agreement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Hanwha Techwin, which is located at: 500 Frank W. Burr Blvd.; Teaneck, NJ 07666; 877-213-1222; www.HanwhaSecurity.com

2.2 IP SERVER

- A. IP Server shall be designed to run on a Windows platform, supporting both Desktop and Server class operating systems including Windows 7, 10(Pro), 2008 R2, 2012, 2016.
- B. It shall run as a Window's Service. This service shall run as part of the local service account. This service shall be running as long as the system is booted and has started Windows. It shall not require the user to be logged in.
- C. It shall store settings in SQL Express and shall not require a full MS-SQL license.
- D. It shall have an option for a 32-bit binary and a true 64-bit binary. In a 64-bit OS, it shall run as a native 64-bit application, not merely a 32-bit application.
- E. The service shall connect to the camera and handle streaming to the server. It shall not require each client to connect to individual cameras.
- F. This service shall allow the cameras to be placed on one network and the clients on a separate network using a different IP range.

- 1 G. The software shall support the ONVIF standard.
- 2
- 3 H. The software shall support Megapixel virtual cameras within a single camera license.
- 4
- 5 I. The server shall only require two ports for streaming video as well as handling any setting
- 6 changes or commands from the client software.
- 7
- 8 J. IP Server shall record the video streams from different cameras.
- 9 1. The service shall handle transcoding of the camera streams if the cameras are
- 10 MJPEG based. The video shall be re-encoded to WMV to reduce storage needs and
- 11 to reduce the impact of streams to clients on the server.
- 12 2. For MPEG-4 based cameras, the video shall be stored in the native codec of the
- 13 server.
- 14 3. For H.264/H.265 based cameras the video shall be stored in the native codec of the
- 15 server.
- 16 4. Each camera will have the option to be able to be stored in different locations (i.e.
- 17 One locally, another on a NAS, a third on a different network share).
- 18 5. Streaming from server to client shall support H.264/H.265.
- 19 6. The server must have Pivot 3 integration.
- 20
- 21 K. IP Server shall support H.264/H.265, MPEG-4, MJPEG and MXPEG based cameras.
- 22
- 23 L. IP Server shall support motion detection at the camera and at the software levels.
- 24
- 25 M. IP Server shall provide graphic examples of what it determines as motion to thick clients if
- 26 the thick client requests it.
- 27 1. The software shall display the motion detection as an outline around the area
- 28 moving.
- 29 2. The software shall provide a bar showing the total percentage of change. This bar
- 30 shall have a slider on it to allow the user to quickly set motion detection.
- 31
- 32 N. IP Server shall allow for multiple zones to be set within an image that support differing
- 33 motion detection values within a cameras field of view.
- 34 1. There shall be no limit on the total number of zones allowed, either on a per camera
- 35 or per server basis.
- 36 2. Zones should allow the ability to ignore motion within an area.
- 37 3. The user shall have the ability to move the zones after the fact.
- 38 4. Motion zones should be able to be tied into a rules engine to allow the software to
- 39 use them as triggers for events.
- 40
- 41 O. IP Server shall support the use of imported maps to show camera placement. These formats
- 42 for these maps will be JPG, GIF or BMP as determined by the user.
- 43 1. Hovering over a camera on a map shall cause it to be displayed in a window on the
- 44 side.
- 45 2. When the camera is displayed on the side, the option to review recently recorded
- 46 video will be available to them.
- 47 3. The user shall be able to embed layouts onto the facility map. Clicking on the layout
- 48 shall change the display of the client software.
- 49 4. Alarms from DIOs shall be able to be embedded as well.
- 50 5. Audio sources shall also be an option.
- 51 6. Other facility maps shall also be an option to embed. Clicking on a different
- 52 embedded map shall bring up that map.
- 53 7. Doors from certain access control systems can be imported and displayed. Hovering
- 54 over the door shall display the last badge used to badge in, a live view of the camera
- 55 associated with the door. The user from this pop up shall be able to see badge events
- 56 and alarm events along with the associated video.

- 1
2 P. IP Server shall not require the administrator to contact the manufacturer to replace a camera.
3
4 Q. IP Server shall support reporting to a diagnostic tool.
5 1. Number of active cameras.
6 2. Active cameras offline.
7 3. Version of the server.
8 4. Amount of disk space left.
9 5. Recording status of the server.
10
11 R. IP Server shall support pre-motion and post motion recording.
12
13 S. IP Server shall support customizable layouts. The layouts will allow for blank spaces within
14 the layout.
15
16 T. IP Server shall support an unlimited number of users.
17 1. Users can be drawn from either an Active Directory server, Novell eDirectory or
18 entered manually.
19 2. There will be five different levels of user.
20 3. Users can be members of a group with settings set for the group. Individual user
21 settings can override the group settings.
22 4. Permissions can be set for live viewing, access to recorded video, control of PTZ
23 cameras, access to audio, the ability to export video, custom layouts, facility maps
24 and rules. Permissions can be defined on a per camera basis.
25 5. It shall support the option of having the users limited to being signed in, to a single
26 location.
27
28 U. IP Server will include a diagnostic version with limited interface, to allow for testing of the
29 server.
30
31 V. It shall support an optional secondary server with failover capacity.
32
33 W. A rules engine shall be included to allow the server to handle more complex tasks.
34 1. Triggers will include:
35 a. Dry contacts (DIO).
36 b. Motion detection of a camera stream.
37 c. Scheduled events. Events can be scheduled on daily, weekly, or monthly
38 basis. Individual events can be handled as well.
39 d. An Alert button for the user interaction in the VI Monitor.
40 e. Inputs sent programmatically via appropriate APIs.
41 f. Access control events from supported Access Control Vendors.
42 2. Actions will include:
43 a. Logging the event.
44 b. Opening or closing a dry contact.
45 c. Sending an e-mail with a custom text message tied to the trigger. Multiple
46 texts will be allowed for different triggers.
47 d. Sending an e-mail with an AVI/MP4 clip from a selected camera.
48 e. Sending an e-mail with a JPG file of a selected event from a camera.
49 f. Opening a live window for a user who is viewing.
50 g. Move a PTZ to a certain preset location.
51 h. Force recording.
52 i. Force recording with audio.
53 j. Instant Replay.
54 k. Sending video to a Network Decoder.
55 l. Switching single camera or layout views.
56 m. Message Instruction.

- 1 o. Moving, copying or deleting of files.
- 2 p. Execute a program or batch file.
- 3 q. Send an ASCII string to a TCP port.
- 4
- 5 X. IP Server shall support time out functionality.
- 6 1. A universal RTSP option shall exist for adding cameras if they are not currently
- 7 supported through native APIs.
- 8
- 9 Y. PTZ functionality within the camera will be supported.
- 10
- 11 Z. Dewarping of Panoramic shall be supported for the following manufacturers:
- 12 1. Advidia
- 13 2. AMG
- 14 3. Axis
- 15 4. Dahua
- 16 5. Hikvision
- 17 6. Oncam
- 18 7. Pelco
- 19 8. Panasonic
- 20 9. Sentry 360
- 21 10. Uniview
- 22 11. Vivotek
- 23 12. Dlink
- 24 13. Dynacolor
- 25 14. EverFocus
- 26 15. GridSmart
- 27 16. IDIS
- 28 17. ACTi
- 29 18. GeoVision
- 30 19. Hanwha
- 31 20. Samsung
- 32 21. ImmerVision
- 33
- 34 AA. IP Server will only stream video to the clients that requested them.
- 35
- 36 BB. If live video is paused, then IP Server shall stop streaming video to the clients to conserve
- 37 bandwidth.
- 38
- 39 CC. IP Server shall support integration with various access control platforms, including:
- 40 1. Imron
- 41 2. MonitorCast v.3
- 42 3. MonitorCast v.4
- 43 4. AMAG
- 44 5. Badge Pass
- 45 6. Blackboard
- 46 7. Continental
- 47 8. Infinias
- 48 9. Isonas
- 49 10. Lenel
- 50 11. Paxton
- 51 12. CCURE
- 52 13. DSX
- 53 14. Gallagher
- 54 15. Maxxess
- 55 16. RBH
- 56 17. S2

- 1 18. Sureview
- 2
- 3 DD. IP Server shall have support panic button functionality through rules engine.
- 4
- 5 2.3 VI MONITORPLUS
- 6
- 7 A. VI MonitorPlus will be a thick client for viewing live and recorded video, along with handling
- 8 administrative tasks.
- 9
- 10 B. The software shall not require a client license to operate.
- 11
- 12 C. The thick client will support an encrypted XML file for storing settings. The file can be set up
- 13 to be shared between many clients, allowing the administrator to update all clients with a
- 14 single file push.
- 15 1. Clients will be able to use Active Directory to authenticate users.
- 16 2. Clients will be able to use Novell E-directory to authenticate users.
- 17 3. VI MonitorPlus shall have a searchable timeline for multiple events.
- 18 4. Motion.
- 19 5. Access Control (integration required).
- 20 6. Rules.
- 21 7. LPR (License Plate Recognition).
- 22 8. VCA (Video Content Analytic).
- 23
- 24 D. VI MonitorPlus will display the servers it's connected to along with the server's cameras in a
- 25 tree view on the left-hand side.
- 26 1. The tree view will allow the user to see the status of the servers that the instance of
- 27 VI MonitorPlus is aware of.
- 28 2. The tree view will also include access to custom layouts, facility maps and action
- 29 buttons.
- 30 3. There will be an option to hide the tree on startup of VI MonitorPlus.
- 31 4. The user shall be able search for cameras using a searchable box on the left-hand
- 32 tree.
- 33
- 34 E. The thick client will not be limited in the number of servers it can connect to.
- 35
- 36 F. Live view will allow views of 1, 2, 4, 8, 9, 10, 13, 16, 25 and 36 cameras. A widescreen
- 37 option for 18 and 24 cameras will also be available.
- 38 1. Layouts will be selectable via icon.
- 39 2. Layouts will not be limited to cameras from a single server.
- 40 3. Users will be able to get layouts to cycle in the client's workspaces.
- 41 4. Layouts shall be able to be put into groups.
- 42
- 43 G. If motion is detected on a camera, the software shall have the option to indicate it by
- 44 highlighting the edge of the live window.
- 45
- 46 H. Live view will allow cameras to be dragged and dropped onto the live view from the left-hand
- 47 tree. Cameras can be duplicated in a view.
- 48
- 49 I. Users will be able to invoke a digital zoom by drawing a box.
- 50
- 51 J. After invoking the digital zoom, VI MonitorPlus shall support the use of picture in picture
- 52 within the zoomed image.
- 53
- 54 K. Digitally zoomed areas will be treated as a digital PTZ.
- 55
- 56 L. PTZ Presets shall be listed in a drop-down menu in the Dynamic Tab.

- 1
- 2 M. Users shall be able to move the PTZ movements simply by clicking on the image, through
- 3 onscreen PTZ controls. Zoom functionality can also be controlled via the scroll wheel of the
- 4 mouse.
- 5
- 6 N. Live view will support a full screen mode that hides the UI. User shall be able to start VI
- 7 MonitorPlus in this full screen mode with a setting.
- 8
- 9 O. Live view shall allow the user to de-warp the video from panoramic lenses and cameras.
- 10
- 11 P. Right clicking on a camera in live view will have the following behaviors:
- 12 1. Right clicking on a camera within live view will allow the user to be able to review
- 13 the recently recorded video for that camera.
- 14 2. Right clicking on a camera within live view will also allow access to the properties
- 15 dialog box for that camera.
- 16 3. Right clicking on a camera will bring up the option to save a still image of the live
- 17 view.
- 18 4. Live audio will be able to be accessed by right clicking on a camera in the live view.
- 19 5. Allowing access to recorded video.
- 20 6. Right-clicking on the Camera tile will allow the users to send video or messages to
- 21 other users in the form of a popup window.
- 22
- 23 Q. Recorded video Synchronized playback will allow for cameras to simply be dragged and
- 24 dropped into the player.
- 25
- 26 R. The exporting of video in VI MonitorPlus shall have Region of Interest capability within a
- 27 recorded image. This will enable segregation of image for export.
- 28
- 29 S. The thick client will include a repair utility for corrupted video.
- 30
- 31 T. VI MonitorPlus will be able to display logging information such as: changes to the server, lost
- 32 camera signals, who exported recorded video, when did users log-on/off and other errors. This
- 33 functionality will be limited to administrative users. The log will be exportable as txt or to the
- 34 Windows clipboard.
- 35
- 36 U. VI MonitorPlus shall also provide real time status updates for server status and camera status,
- 37 including the CPU usage, disk usage, bandwidth usage, licensing and number and names of
- 38 users who are logged in.
- 39
- 40 V. The system will support an Alarm Log to make it easier to find DIO based events.
- 41
- 42 W. Facility maps will be available in the software for viewing.
- 43 1. When the user hovers over a camera in the facility map it will display the camera in a
- 44 window off the side of the map.
- 45 2. While a camera is displayed it will allow access to recorded video from that camera
- 46 as well as the live stream.
- 47 3. Cameras will display where they are pointed.
- 48 4. Embedded layouts will change the layout of VI MonitorPlus if they are clicked on.
- 49 5. Embedded Facility maps will cause the current map to change to the embedded map
- 50 if clicked on.
- 51 6. The user will have the option of importing and placing doors from supported access
- 52 control partners on the map. This shall allow them to see badge events as well as
- 53 alarm events. It shall also support the ability to lock and unlock doors from the map.
- 54 7. Integrated Panic button events will be visible on the facility map.
- 55
- 56 X. VI MonitorPlus will support the DCZ Joystick as well as standard USB joysticks.

- 1
- 2 Y. The software shall support the ability to open a live window that can be moved around. This
- 3 window will be able to access the view of any camera or layout the user has access to.
- 4
- 5 Z. VI MonitorPlus will support multiple screen user environments for dynamic user interface.
- 6
- 7 AA. The user will be able to enable or disable the following settings:
- 8 1. Server name in the live view.
- 9 2. Camera Name in the live view.
- 10 3. Audio notification on motion.
- 11 4. Forcing aspect ratio.
- 12 5. Use Direct Show for display.
- 13 6. Double clicking to change the server layout.
- 14 7. Double clicking expands the camera.
- 15 8. Allowing multiple live windows.
- 16 9. Block live windows from popping up.
- 17 10. Live window always on top.
- 18 11. The speed in which layouts cycle.
- 19 12. Hiding left tree on start up.
- 20 13. Launching Facility maps on start up.
- 21
- 22 BB. Users with Administrator privileges will be able to configure the server and camera settings.
- 23 Users will also be able to test SMTP settings and database settings.
- 24 1. Users will be able to configure the framerate of the camera, including the option to
- 25 have the server record continuously from 1 to 3 fps with the option to go to the
- 26 cameras designated frame rate on motion detection.
- 27 2. Users will be able to select various time-lapse options for the camera.
- 28 3. Users will be able to select the camera stream type.
- 29 4. Users will be able to select camera or server-side motion detection.
- 30
- 31 CC. Users will be able to access a graphic representation of what the server's motion detection
- 32 settings are picking up through the timeline.
- 33
- 34 DD. Users will be able to configure user settings as well as layout settings from within the thick
- 35 client.
- 36
- 37 EE. VI MonitorPlus will allow users to send video to other users, allowing for remote live pop ups
- 38 of video of important events.
- 39
- 40 FF. VI MonitorPlus will support Layout touring. Selecting a layout will cycle through a list of
- 41 cameras.
- 42
- 43 GG. User shall be able to allow for remote support via VI MonitorPlus.
- 44
- 45 HH. VI MonitorPlus will allow Region of Interest searches (a.k.a. SmartSearch functionality).
- 46
- 47 2.4 WEB CLIENT
- 48
- 49 A. The Web Client shall be a truly thin client with no download required other than an internet
- 50 web browser or standard web browser plugins.
- 51
- 52 B. The Web Client shall be platform independent and run within Microsoft Edge, Internet
- 53 Explorer, Firefox, Safari, and Google Chrome.
- 54
- 55 C. Users will not be able to change any settings within IP Server via the thin client without
- 56 Admin privileged.

- D. Users will be able to select layouts for live viewing, or individual cameras or groups of cameras.
- E. Users will be able to access recorded video.
- F. Users will be able to download recorded video from the system.
- G. Users will be able to use the motion log to find recorded video.
- H. The Web Client shall support the use of facility maps.
- I. The Web Client will support the use of custom layouts.
- J. The Web Client shall allow remote access for iPhone, Blackberry, Windows Mobile, and Android mobile phones without the installation of an app.

2.5 VIDEO MANAGEMENT SYSTEMS (VMS)

- A. Video Management System (VMS)
Software: Wisenet Wave v4.2 as manufactured by Hanwha-Techwin America.
 - 1. System Requirements:
 - a. Open video platform designed for use in any video application.
 - b. Specified Software: To include, free of charge, any API or SDKs necessary to integrate third party devices and systems.
 - c. Specified Video Management Solution's Architecture: To include Desktop, Media Server, Mobile, and Cloud applications.
 - 2. Software Components Characteristics: Four applications working seamlessly together.
 - a. Cloud Application: Enables simple remote connectivity, viewing, and management of an unlimited number of systems and users.
 - b. Media Server Application: Responsible for discovering, connecting to, and managing system users, devices, and associated data.
 - c. Desktop Application: Capable of acting as a stand-alone media player or as a client application for connecting to and managing systems.
 - d. Mobile Application: For iOS and Android devices that allows users to connect to, view, search, and control IP cameras over Wi-Fi or Data networks.
 - 3. Built-In Developer and Integration Tools: Accessible from System Server's Web Admin Interface (compatible with all major browsers).
 - a. Server API: SUNAPI implementation giving developers the ability to access every system feature available.
 - b. API Change Log: List of breaking changes in API from version to version.
 - c. Video Source Integration SDK: Integrate virtually any live or recorded video source (IP Cameras, NVRs, DVRs, etc.) into the VMS with methods for discovering, displaying, analyzing and recording video, as well as integrating device I/O ports and related motion detection information.
 - 4. System Architecture:
 - a. Server Hive Architecture:
 - 1) System servers are equal synchronizing system databases in real-time.
 - 2) Users can connect to any system server to see and manage entire system.
 - 3) Servers support automatic camera failover ensuring limited loss

- of video recording in event of hardware or network failure.
 - b. One-click System Wide Updates:
 - 1) System Administrators Capabilities:
 - a) Upgrade entire system via single button in Desktop Application.
 - b) Upgrade on demand to latest release or specific builds with specific functionality or bug fixes.
 - c. Use secure technologies for inter-application communication and security.
 - 1) Email Server: Client (Mobile, Desktop, Web) Communications - HTTPS Email - TLS / SSL - TLS; default option.
 - 2) Salted/Hashed Passwords: Local credentials protected using a salted MD5 hash, cloud credentials should use a complex multi-level hash.
 - d. The VMS will not require any licenses to increase the number of supported devices, users, or servers.
5. VMS Server Application:
 - a. Runs on the Following Operating Systems:
 - 1) Microsoft:
 - a) Windows 10 Professional, Windows 10 IOT Enterprise
 - b) Windows Server 2019.
 - b. Minimum Compatible Computing Hardware:
 - 1) Any hardware able to run a compatible operating system.
 - 2) Capable of recording 128 dual-streaming IP cameras (256 streams) on a single core of an Intel Core i5 processor.
 - c. Performance:
 - 1) Automatically discover, stream, and record any ONVIF Profile S IP camera located on same subnet as server application.
 - 2) Manually discover, stream, and record RTSP, HTTP, or UDP (multicast, unicast) streams.
 - 3) Automatic camera failover without any additional licenses.
 - 4) Unlimited number of users and custom user roles.
 - 5) User Login Credential Management: LDAP / Active Directory / Open LDAP integration.
 - 6) Record and Stream
 - a) Video: H.264, H.265, and MJPEG.
 - b) Audio: AAC, PCM (Mu-Law, A-law), g726, and MP3.
 - 7) Transcode Streams on Demand: For delivery to 3rd party system devices.
 - a) Codecs: H.265, H.264, MJPEG or WebM.
 - 8) Pass-through high-res or low-res HLS streams from connected devices.
 - 9) Support Addressing: IPv4 or IPv6.
 - 10) Operator ability to change size of reserved disk space for storage drives.
 - 11) Concurrent recording of all connected cameras / streams to two servers in real-time.
 - 12) Server-side, CPU-based motion analysis for all connected IP cameras with no perceptible increase, less than 3 percent, in CPU usage.
6. VMS Desktop Application:
 - 1) Runs on the Following Operating Systems:
 - a. Microsoft:

- 1) Windows 10
- 2) Windows 10 IOT Enterprise Solutions.
- 3) Windows Server 2019
- b. Apple / Mac.
 - 1) OSX 10.12: Sierra.
 - 2) OSX 10.13: High Sierra.
 - 3) OSX 10.14: Mojave.
7. Minimum Compatible Computing Hardware:
 - a. Any hardware able to run a compatible operating system with a CPU that supports OpenGL 2.1 and Intel HD Graphics 3000 (or higher).
 - b. Will not require any dedicated graphics drive to work at full capacity; 64 streams on a 64 bit OS, 24 streams on a 32 bit OS, and use the CPU for all video decoding and rendering.
8. Performance and Basis Structure:
 - a. Navigation Panel: Main menu button, an interactive cloud-login icon, tabbed layouts, minimize and maximize icons, a contextual help icon, and a close application icon.
 - b. Resource Panel (Left): Contains all system resources (Servers, Devices, Users, Layouts, Offline files, etc.) with collapsible structure and a keyword search mechanism to allow operators to quickly search for a display live streams / cameras, offline video and image files, or any combination thereof.
 - c. Notifications Panel (Right): Shows all system or rules- engine generated notifications which can be clicked on to display relevant resource in the viewing grid.
 - d. Timeline Panel (Bottom): Allows for navigation and search of recorded video files.
 - e. Viewing Grid (Main Viewing Area): A flexible adaptive grid interface which allows operators to create and share customized layouts of system resources.
9. Operation: Allow operators to do the following.
 - a. Scroll to and zoom in on any zone of viewing grid.
 - b. Drag and drop to reassign cameras from one server to another server.
 - c. Via a flexible timeline, view dates of any and all archived video in the System for a specific camera, or groups of cameras.
 - d. Manually Create Bookmarks: With start time, end time, name, description, and tags, for later search. Bookmarks must also be able to be created using the Rules engine.
 - e. Execute a Smart Motion Search: By selecting a subset of a live camera stream with results shown in red on the flexible timeline. Smart Motion search should be able to search a year (12 months, 365 days) of archived video in less than one second.
 - f. Search video archives by date and time with a responsive, adaptive timeline. View, Search and Export All system events, System bookmarks, System logs and Audit trail of operator actions and replay related video.
 - g. Create and share lockable layouts.
 - h. Modify and save a shared layout to affect an instantaneous change to that layout on the VMS Desktop application of any user connected to the system viewing that layout (when the system administrator saves the layout the layout will update in real time for any user viewing that layout).
 - i. Support two-way audio between operators and supported devices.
 - j. Support audio alerts as an action that can be played on users' computers or connected system devices.

- k. Force open an alarm layout triggered by any system or 3rd party event with one or many associated cameras or resources.
- l. Force users to set the camera's initial password upon enrollment for best cyber security practices.

2.6 VMS SOFTWARE LICENSES

- A. All new systems shall provide, at minimum, one WAVE VMS license per camera. Additionally, if additional cameras are being added to existing system, dealer shall include one new WAVE license per camera. Following are the acceptable WAVE VMS camera license references.
- B. Model: WAVE-PRO-01,-04,-08,-16,-24,-48 as manufactured by Hanwha Techwin America
 - 1. Description: WAVE camera license, Enables one IP stream recording per “-0x” license(s) purchased.
 - a. Purchase sufficient quantity of WAVE licenses as needed to record the number of camera streams being added to a WAVE System
 - b. Note: Cameras that used only for Live Patient Room Monitoring and will NOT be recorded, then WAVE licenses for these specific cameras are not necessary. However, proper sizing of the Recording Server is still required to support the cameras.
- C. Model: WAVE-VW-02 as manufactured by Hanwha Techwin America.
 - 1. Description: WAVE, Video Wall License, Enables displaying video on up to two (2) additional monitors with remote control of video displayed on those monitors.
- D. Model: WAVE-ENC-04 as manufactured by Hanwha Techwin America
 - 1. Description: WAVE, 4 Channel Encoder License
- E. Model: WAVE-IO-01 as manufactured by Hanwha Techwin America
 - 1. Description: WAVE, I/O module license, Enables one (1) I/O module

2.7 CLIENT WORKSTATIONS

- A. Model: WWT-P-7401 WAVE Client Workstation supporting up to Four (4) attached monitors
 - 1. The Workstation shall have a dedicated operating system drive to facilitate accelerated boot and application load times
 - a. OS Drive – 1x 256GB SSD internally mounted with Operating System - Microsoft Windows 10 Pro
 - 2. Video Storage - support to add additional 3.5” drive with capacity options for 1TB, 2TB, 4TB, 8TB, 10TB, 12TB, or 14TB per drive at Speed of 7200 rpm
 - 3. Processor: Qty 1 Intel® 9th Generation Core™ Processor, Intel® Core™ i7-9700, 3.0Ghz to 4.7Ghz (8 Cores, 8 Threads, 12MB) and 16 GB DDR4 RAM memory
 - 4. Graphics Cards - NVIDIA® Quadro® P620 with 4x HDMI adapters
 - 5. Network Controller 1. Ports: 1 x 1GbE RJ45
 - 6. Additional Ports - Video output: Varies with GPU, (1) HDMI 2.0b, (1) DisplayPort 1.4 on motherboard, up to (4) DisplayPort 1.4 , USB: Front: (2) USB 3.1, (2) USB 2.0, Rear: (2) USB 3, (2) USB 2.0
 - 7. Electrical - Power: 100–240 V AC, auto-ranging, Power Supplies: 200W 80 Plus Bronze
 - 8. Mechanical - Dimensions (w x d x h): 3.7" (97mm) x 11.5" (292mm) x 11.4" (290mm)
 - 9. Weight: 11.42 pounds (5.14 kg)
 - 10. Environmental - Operating temperature: 50°F - 95° F (10°C - 35°C)

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
 - 15
 - 16
 - 17
 - 18
 - 19
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
 - 28
 - 29
 - 30
 - 31
 - 32
 - 33
 - 34
 - 35
 - 36
 - 37
 - 38
 - 39
 - 40
 - 41
 - 42
 - 43
 - 44
 - 45
 - 46
 - 47
 - 48
 - 49
 - 50
 - 51
 - 52
 - 53
 - 54
 - 55
 - 56
- B. UPS & ELECTRICAL SURGE PROTECTION
1. All Client Workstations shall be connected to a properly sized Pure Sine Wave Power Conditioning UPS or circuit to prevent voltage fluctuations (increase or decrease) that can affect operation and cause damage to the equipment.
 2. All Client Workstations shall be installed on an electrical circuit that includes protection against transient voltage surges.
 3. It is recommended that all UPS systems are sized to provide back-up power for a minimum of 20 minutes or owner stated guidance, with 20% growth capacity, to maintain Video System Operation during brief outages or generator activation and power cut over.
- 2.8 ACCESSORIES
- A. Accessory Products: Provide the following accessories to properly install and mount all cameras as required by the specific camera installation locations, as applicable to the system selected and as scheduled on the Drawings.
1. Pendant Caps
 2. Corner Mount Brackets
 3. Wall Mount Brackets
 4. Recess Mount Kits
 5. Pole Mount Brackets
 6. Back box mounts
 7. 2x2 Ceiling Mounts
 8. Sun Shields
 9. Work Boxes
 10. Smoked dome covers.
 11. PTZ/Dome housings.
 12. PTZ/Dome mounts.
 13. HD CCTV accessories.
 14. Network camera POE injectors & accessories.
 15. UTP video devices.
 16. Monitor stands.
 17. Surge Protection
 18. UPS Battery Back Up
 19. UPS Circuits
- 2.9 IP SECURITY CAMERAS
- A. Camera Model Selection Guidelines
1. Brand Selection - All cameras provided to Tomball ISD shall be Hanwha Techwin Wisenet cameras. If a dealer chooses to install another brand of camera at any Tomball ISD facility, the camera(s) shall be replaced, at no cost to the Tomball ISD, by the installing dealer with the following approved Hanwha Techwin Wisenet cameras models.
 - a. Substitution Request – Dealer may request to submit alternate Hanwha cameras models to Tomball ISD for review and acceptance (or not) by Security Management. If so, specific model acceptance must be approved by Tomball Security Management prior submitting any quotes.
 2. Indoor Camera Guidance (presumes wide angle lens FoV & 40PPF)
 - a. Single Sensor
 - 1) QNV-8080R – 5MP for viewing areas up to 35’ away, larger rooms.
 - 2) XNV-6011W – 2MP For viewing smaller areas
 - a) Viewing area up to 15’
 - 3) XND-C6083RV – 2MP Viewing Entrance / Exit Doors

- a) Viewing area up to 20'
 - 4) XND-C8083RV – 6MP Camera, Lobbies, Waiting areas, larger rooms
 - a) Viewing area up to 40'
 - 5) XND-C9083RV – 4K Large Lobby's, long Hallways, large rooms, warehouses, or situations requiring highest resolution details.
 - a) Viewing area up to 55'
 - 6) PND-A9081RV – 4K AI camera for high level awareness of object (person/vehicle) detection and alerting
 - a) AI for high level awareness object detection (people / vehicle) classification and attributes.
 - b. 360° Fisheye Camera
 - 1) XNF-9010RV – 12MP 360° View
 - a) larger rooms (30'x30')
 - b) or areas requiring greater resolution detail such as cash handling, people identification, etc.
 - c. Multi-Sensor Camera
 - 1) PNM-9000VD – Dual 2x 5MP Camera for Hallways (2 views)
 - a) Viewing area up to 40' each camera direction
 - 2) PNM-8082VT – Triple 3x 2MP Camera for T- Hallways (3 views)
 - a) Viewing area up to 20' each camera direction
 - 3) PNM-9084QZ – Quad 4x 2MP Camera for 4 Hallways (4 views) / rooms
 - a) Viewing area up to 20' each camera direction
 - 4) PNM-9085RQZ – Quad 4x 5MP Camera for 4 Hallways (4 views) / rooms
 - 5) Viewing area up to 40' each camera direction
3. Outdoor Camera Guidance (presumes wide angle lens FoV & 40PPF)
 - a. Single Sensor Camera
 - 1) XNV-C6083R – 2MP Camera Viewing Entrance / Exit Doors
 - a) Viewing area up to 20'
 - 2) XNV-C8083R – 6MP Camera Area View
 - a) Viewing areas up to 40'
 - 3) XNV-C9083R – 4K Camera larger area views
 - a) Viewing areas up to 55'
 - 4) PNV-A9081R – 4K Camera AI high level alerts / notifications
 - a) AI for high level awareness object detection (people / vehicle) classification and attributes.
 - b. Panoramic Camera - 180° View, Parking Lots & Cameras Mounted on Building for Wide Area Views, Pedestrian Drop Off Areas, etc.
 - 1) PNM-9022V – 4x2MP Panoramic 180° View Camera,
 - a) Viewing distances up to 30' radius
 - 2) PNM-9031RV – 4x5MP Panoramic 192° View Camera
 - a) Viewing distances 50'+ radius
 - 3) PNM-9085RQZ – Quad 4x 5MP Camera Parking Lot Camera, 360° Viewing, Under Canopy, etc.
 - c. 360° Fisheye Camera
 - 1) XNF-9010RV – 12MP 360° View
 - a) larger rooms (30'x30')
 - b) or areas requiring greater resolution detail such as cash handling, people identification, etc.
 - d. Multi-Sensor Camera
 - 1) PNM-9000VD – Dual 2x 5MP Camera for 2 views

- a) Viewing area up to 40' each camera direction
 - 2) PNM-8082VT – Triple 3x 2MP Camera for 3 views, 180°~270°
 - a) Viewing area up to 20' each camera direction
 - 3) PNM-9084QZ – Quad 4x 2MP Camera for 4 views, 360° coverage
 - a) Viewing area up to 20' each camera direction
 - 4) PNM-9085RQZ – Quad 4x 5MP Camera for 4 views, 360° coverage
 - a) Viewing area up to 40'+ each camera direction
4. Elevator Camera
 - a. XNV-6012 – Small form factor surface mount in elevator
 - b. Include Optional Power Over Wire as needed:
 - 1) Hanwha Model TEU-F01 for powering (POE) camera over Unshielded Twisted Pair (UTP / CAT wire) elevator cab traveler wire
 - 2) Hanwha Model TEC-C01 for powering (POE) camera over Coax elevator cab traveler wire (use with legacy (existing) Coax camera upgrades).

B. Minimum Camera Performance Requirements

1. Video Compression and Transmission: Cameras shall have the following properties relating to video signals they produce.
 - a. Compression: H.265, H.264 and MJPEG. Each derived from a dedicated encoder and capable of being streamed independently and simultaneously.
 - 1) H.265 and H.264: Maximum of 30 fps at all resolutions
 - 2) MJPEG: Maximum of 30 fps
 - b. Video Stream Profiles: Able to configure 6~10 independent profiles with differing encoding, quality, frame rate, resolution, and bit rate settings.
 - c. Video Streams: 10 independent stream types using unicast protocol.
 - 1) Multicast and unicast video streaming.
 - d. DDNS Configurable: At no additional cost by manufacturer.
 - e. Smart Codec: Dynamic GOV, and Dynamic FPS to efficiently manage bitrate of video stream.
2. Camera Physical and Performance Properties:
 - a. Impact Protection: IK08~IK10 vandal resistance for indoor cameras
 - b. IP66 rating minimum for Outdoor Cameras
 - c. Resolution and FPS
 - 1) 2MP camera imager sensors shall transmit full 1080P resolution (1920x1080) at a 30FPS using all Codecs (H.265/H.264/MJPEG) with no FPS reduction with the implementation of WDR and / or analytics in the camera.
 - 2) 5MP camera imager sensors shall transmit full 2560x1920 resolution at a 30FPS using all Codecs (H.265/H.264/MJPEG) with no FPS reduction with the implementation of WDR and / or analytics in the camera.
 - 3) 6MP camera imager sensors shall transmit full 3328x1872 resolution at a 30FPS using all Codecs (H.265/H.264/MJPEG) with no FPS reduction with the implementation of WDR and / or analytics in the camera.
 - 4) 4K camera imager sensors shall transmit full 3840x2160 resolution at a 30FPS using all Codecs (H.265/H.264/MJPEG) with no FPS reduction with the implementation of WDR and / or analytics in the camera
 - d. Configurable privacy masking regions utilizing a 4 point polygon

- e. Camera Models with IR Illumination True day and night operation with removable IR cut filter.
 - f. Digital Noise Reduction: 2D and 3D technology.
 - g. Cameras for viewing in darkness shall include Integral IR illumination, providing effective visibility of 65.62 ft (20 m) at 0 Lux when activated in black and White mode.
 3. Intelligence and Analytics: A suite of integral intelligent operations and analytic functions to include:
 - a. Motion Detection: Eight definable detection areas with 8 point polygonal zones, minimum and maximum object size.
 - b. Logical Events Detection from Camera Video Input:
 - 1) Tampering (scene change).
 - 2) Defocus detection.
 - 3) Motion detection with metadata.
 - 4) Virtual Area Based Event:
 - a) Enter or exit.
 - 5) Virtual Line Based Event:
 - a) Directional detection.
 - b) Crossing.
 4. Interoperability: ONVIF Profile S, G and T compliant and SUNAPI API
 5. Camera Characteristics:
 - a. Built-in web server, accessed via standard browsers including MS Internet Explorer, Firefox, Chrome and Safari.
 - b. Dual edge recording slot like Micro SD/SDHC/SDXC memory card with configurable pre-alarm and post- alarm recording intervals.
 - c. Bi-directional audio.
 - d. Alarms and Notifications supported:
 - e. PoE capable.
 6. Multi-Sensor Camera Additional Requirements
 - a. In addition, all multi-sensor cameras (including Duo (2) Imager Sensors and Quad (4) Imager Sensors) shall also include the following Model: PNM-7002VD/PNM- 9000VD, PNM-9084QZ, PNM-9084RQZ, PNM-9085RQZ, PNM-9002VQ, PNM-9022V and PNM- 9030V, PNM-9031RV, PNM-9322VQP as manufactured by Hanwha Techwin America.
 - b. Each Video Channel shall utilize a dedicated SOC to that Video Channel to process and deliver full framerate video at 30 FPS using all Compression Codecs (H.265, H.264 and MJPEG), with no degradation or reduction to any individual Video Channel or Collectives Channels when enabling WDR or advanced video analytics.
 - c. Each Video Channel shall support individual enablement of intelligent analytics, WDR, and codec selection independent of the remaining video channels.
 - d. Each Channel supports SD card.
 - e. One single power supply for all multi-channels
 - C. UPS & Electrical Surge Protection
 1. All Network Camera to NVR Connections Shall incorporate an appropriate in line network Surge Protection Device when the Network Camera is located on the exterior of a building and connecting network switch / Network Recorder on interior of building.
 2. All Critical Operation Network Cameras shall be on a POE Switch attached to a Pure Sine Wave Power Conditioning UPS or UPS circuit that is sized for the specified required operational time. It is recommended that all UPS systems are sized to provide back-up power for a minimum of 20 minutes or owner stated guidance, with 20% growth capacity, to maintain Video System Operation during brief outages or generator activation and power cut over.

2.10 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

A. Licensing

1. Provide the owner with all licenses as required for installation

PART 3 - EXECUTION

3.1 PREPARATION

A. System Integrator: Confirm the solution proposal planning and design with the installing contractor.

B. The network design and configuration to be verified for compatibility and performance with the input/output devices.

C. Network Configuration: Tested and qualified by Contractor prior to remote device installation.

D. Equipment to be tested and configured in accordance with instructions provided by the manufacturer prior to installation.

E. All firmware found in products to be the latest and most up to date provided by the manufacturer, or of a version as specified by the provider of the Video Management Application (VMA).

F. All equipment requiring users to log on using a password to be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

G. Confirm hardware will be stored in an environment where temperature and humidity are in the range specified by the Manufacturer.

3.2 INSTALLATION

A. General

1. Install products per manufacturer's recommendations and approved submittals.
 - a. Comply with documentation provided by the System Integrator to ensure all steps have been taken to provide a reliable, easy-to-operate system.
2. Contractor personnel must comply with all applicable state and local licensing requirements.
3. Before permanent installation of the system, the Contractor will test the system in conditions simulating the final installed environment witnessed by the System Integrator. Adjust as required until proper operation is achieved.

B. Cable Support:

1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
3. Cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be

- 1 used inside the control panels as required to manage the wires within each type of
2 panel.
- 3 5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly
4 to the building's steel or supported in any other method than that stated above.
- 5 6. It is the responsibility of the installing contractor to coordinate with all other trades
6 on the project to insure that the pathway of this system does not interfere with the
7 installation of the other trades and to prevent the installed product of other trades
8 from putting strain on the installed wiring.
- 9 7. Do not route cable through webbing of structural steel.
- 10
- 11 C. Conduit / Raceway:
- 12 1. All wire shall be installed in an approved conduit/raceway system (except where
13 permitted by NEC and the local authority having jurisdiction). Maximum conduit
14 "fill" shall not exceed 40% per NEC.
- 15 2. Conduit and raceway system shall be installed as specified under the general
16 electrical section of the specifications, and per NEC.
- 17 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop
18 drawings.
- 19 4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide
20 conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical
21 rooms, or other areas where wiring might be exposed or subject to damage.
- 22 5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings
23 must be installed prior to installing cable. Cutting bushing to install around installed
24 cables will not be accepted.
- 25
- 26 D. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors
27 wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or
28 smoke barriers and in the wiring closet.
- 29
- 30 E. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic
31 conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
- 32
- 33 F. Provide three-sided pre-finished metal hood and seal to wall where conduit penetrates exterior
34 wall.
- 35
- 36 G. Install new roof mounted conduits on portable pipe supports – (low profile type), as
37 manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof
38 protection pads under each support. Coordinate location and routing with design engineer
39 prior to rough-in or installation of system.
- 40
- 41 H. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick,
42 and sealed top and sides (not bottom)
- 43

44 3.3 EQUIPMENT RACK CONFIGURATION

45

- 46 A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings.
47 All cabling shall be routed so as to avoid interference with any other service or system,
48 operation, or maintenance location. Avoid crossing areas horizontally just above or below any
49 riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without
50 difficulty at a later time by maintaining a working distance from these openings.
- 51
- 52 B. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that
53 adequate wall or backboard space is available for current and future equipment. All cable runs
54 within the wiring closet shall be horizontal or vertical within the constraints of minimum cable
55 bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to
56 electrical conduit or other equipment.

- 1
2 C. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch
3 panels.
4
- 5 3.4 WIRING INSTALLATION
6
7 A. General:
8 1. Cabling between wiring closet and camera locations shall be made as individual home
9 runs. No intermediate splices may be installed or utilized between the wiring closet
10 and the camera location.
11 2. All cable must be handled with care during installation so as not to change
12 performance specifications.
13
14 B. Placement: All cabling and associated hardware shall be placed so as to make efficient use of
15 available space. All cabling and associated hardware shall be placed so as not to impair the
16 Owner's efficient use of their full capacity.
17
- 18 3.5 DOCUMENTATION
19
20 A. Labels: The Contractor shall label all outlets using permanent machine engraved labels
21 approved by the Owner. Label patch panels in the wiring closet to match those on corresponding
22 camera locations. The font shall be at least one-eighth inch (1/8") in height, block. All labels
23 shall correspond to as-builts and to final test reports.
24
25 B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond
26 to locations on video server. Labeling system shall correspond to the Owner's labeling system.
27 Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and
28 outlets.
29
30 C. All cables shall be labeled at both ends with a machine label and all terminations shall be
31 stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA
32 standard 606 and include interconnect cable identification numbers.
33
34 D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-
35 built plans.
36
- 37 3.6 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS
38
39 A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so
40 that the testing may be witnessed.
41
42 B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series
43 of end-to-end installation performance tests. The Contractor shall submit for approval a
44 proposal describing the test procedures, test result forms and timetable for all copper and fiber
45 optic cabling.
46
47 C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures
48 discussed below is predicated on the Contractor's use of the recommended products and
49 adherence to the inspection requirements and practices set forth. Acceptance of the completed
50 installation shall be evaluated in the context of each of these factors.
51
52 D. Errors: When errors are found, the source of each error shall be determined, corrected and the
53 cable retested. All defective components shall be replaced and retested. Retest results must be
54 entered on the test results form. All corrections shall be made prior to final acceptance test.
55
- 56 3.7 INSPECTION

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

- A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Architect/Engineer may observe before acceptance.

3.8 WARRANTY

- A. Guarantee and warrant all equipment provided for a period of 3 years following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration.
- B. All such warranties shall include all parts (DVR's, and Power Supplies).
- C. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion

END OF SECTION

SECTION 28 23 05

EXPANSION OF EXISTING INTRUSION DETECTION SYSTEM - Bosch

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Expand the existing security system as required. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings and all other accessories required to provide a complete and operable system.
- B. Security system devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system as specified. The Contractor shall provide all security system devices required for complete corridor perimeter coverage acceptable to all governing authorities.
- C. The system shall include intrusion for all egress corridors in the building.
 - 1. The Control System shall be the product of a single manufacturer.
 - 2. Tag all conductors or cables at each end
 - 3. Installation of security panels
 - 4. Interconnection of security panels
 - 5. Installation of new security devices
 - 6. Full coverage of all egress corridors
 - 7. Preconstruction meeting with Owner's personnel, installing technician and project superintendent
- D. The system shall be wired as a Class B system for all circuits.

1.2 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

- A. Governing Authorities:
 - 1. UL864 – Control Units System (L, CS, -A, M, SS, WF)
 - 2. UL1610 – Central Station Burglar Alarm Units
 - 3. UL609 – Local Burglar Alarm Units
 - 4. UL365 – Police Station Burglar Alarm Units
- B. Local & State Building Codes
- C. Requirements of Local Authorities having Jurisdiction
- D. Underwriters Laboratory Requirements and Listings for use in Security Alarm Systems.
- E. Requirements of American Disabilities Act (Public law 101-336).
- F. Local Accessibility Standards
- G. Texas Insurance Code.

1.3 QUALITY ASSURANCE

- A. Contractor Qualifications:

1. The installing contractor shall be the authorized representative of the Security Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least five years.
2. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems.
3. The installing contractor shall provide 24-hour, 365 day per year emergency service with factory trained service technicians.
4. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least five (5) years.

1.4 SUBMITTALS

- A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
 1. Complete point-to-point wiring diagrams.
 2. Riser diagrams.
 3. Complete floor plan drawings locating all system devices.
 4. Factory data sheets on each piece of equipment proposed.
 5. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
 6. Complete system bill of material.
 7. Line by line specification review stating compliance or deviation.
- B. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bosch – D9412GV4 – Existing Panel

2.2 BURGLAR ALARM SYSTEM

- A. The existing security control panel shall have a total capacity of 128 zones. Base panel shall have a capacity of 16 hardwire zones and 112 addressable zones on two addressable loops. All zones shall be fully supervised and programmable. Panel shall be complete with integral power supply and supervised battery charger, auxiliary power for powering security detection devices, programmable switched auxiliary power supply, integral supervised digital alarm communicator, supervised bell/siren output, and two general purpose programmable outputs which can be programmed as general purpose outputs or as the system's addressable loops.
- B. Topology: The system shall be complete with a standard, non-shielded, 4- conductor station wire bus (Combus) for powering and communicating with remote hardwired system expansion modules and devices. The Combus shall be composed of up to 4 legs, with each leg up to 1,000 feet long.
- C. Voice Assisted Status & Control: The system shall be capable of providing system status and control via any local or remote touchtone telephone with the system providing system status information by voice. The system shall include a word library and allow custom words for zone labels.
- D. Scheduling: The system shall provide for 99 date schedules with 4 intervals per schedule, 4 holiday schedules with 2 years of scheduling capacity, 50 open/close suppression schedules and

16 automation schedules. All schedules shall be programmable via the LCD keypads and via downloading either locally or remotely.

E. Panel Zone Expansion: The panel shall be expandable to a maximum of 128 zones by adding standard hardwired 8 and/or 16 zone modules connected to the base panel via the Combust, by adding up to 112 addressable detection devices to one or both of the addressable loops on the base panel, and by adding a 64 zone 900 MHz spread spectrum wireless receiver to the 4-wire communication bus. The system shall be capable of expansion using hardwired, addressable and wireless simultaneously in any mix that suits the application.

1. The system shall be addressable using Combust, hardwired.

F. System Keypads: The system shall accommodate up to 16 LCD keypads, which are powered from the base panel via the 4-wire communications bus. LCD keypads shall have a display capacity of at least 32 alphanumeric characters with adjustable brightness and contrast. Keys shall be backlit for low light level ease of use. Keypads shall include individual "Armed", "Ready" and "Trouble" indicators, three keypad activated alarm keys, and programmable 'function' keys.

G. User Codes: The system shall provide for 1,000 user codes selectable as either 4 or 6 digits. For Access Control, user codes shall be assignable to 1 of 64 access levels. User codes shall be assignable to one or multiple partitions.

H. Partitions: the system shall be programmable for up to 8 fully independent partitions. Each partition shall have its own account Code. Keypads shall be assignable as 'partition' keypads or "global" keypads. Each zone in the system shall be assignable to one or more partitions.

I. Ground Fault Detection: The system shall include an integral ground fault detector, which shall detect a single ground fault on any extended conductor in the system.

J. Supervision: Each zone in the system shall be supervised. The base panel and any remote panel with its own AC inputs shall be supervised for AC loss. Batteries for the base panel and all remote panels shall be supervised for low power and be short circuit protected. Each addressable device and each wireless input device shall be supervised for its presence. The Combust bus shall be supervised for low voltage and the presence of each enrolled module and keypad. Digital alarm communicators shall be supervised for telephone line trouble and failure to communicate and the system shall report any cellular communication panel trouble.

K. False Alarm Prevention: The system shall include the following false alarm prevention features: audible exit delay, arm/disarm bell squawk, audible exit fault, urgency on entry delay, no entry arming/disarming. Swinger shutdown programmable by zone, transmission delay by zone, AC fail, TLM trouble and low battery trouble transmission delay, recent close code transmission, police code (cross zone) transmission, opening after alarm transmission, and arming/disarming from outside the protected space using access control.

L. Central Station Reporting: The system shall provide high speed 20 bps 1400/2300 Hz. handshake, contact ID and SIA reporting formats and shall be capable of being programmed to call up to 3 telephone numbers. The system shall also allow communication to a pager. The telephone numbers shall be programmable for "backup" dialing should the primary number fail. The system shall be programmable for split reporting such that alarms/restorals, openings/closing and miscellaneous events can be sent to different telephone numbers. The system shall report a separate account code for each partition and for non-partition (system) events.

1. The system shall provide opening/closing scheduled suppression to prevent opens and closes from being reported to the central station. The system shall be capable of reporting all alarms, trouble, and system status information by combinations of all communication methods installed including: digital communicator, a cellular transmitter, and DVAC.

- 1 M. System Printer: The system shall be capable of including a serial output for a hard copy printer
2 installed anywhere on the Combust. All system events, alarms and restorals shall be printed and
3 each event shall include the partition, date and time.
4
- 5 N. System Event Buffer: The system shall have a 3,000-event buffer. All events shall be printable
6 from the system printer. The 2,800 most recent events shall be viewable by keypad LCD display.
7 All events shall be viewable by upload/download PC.
8
- 9 O. Power Supply/Relay Output Modules: The systems shall be capable of including up to 64 fully
10 programmable output relays with form 'C' contacts rated 2Amps at 30VDC. Relays shall be
11 added in modules of four and may be located anywhere on the Combust. Each module shall
12 include a supervised 350mA 12VDC battery charger, and integral power supply to supply up to
13 1.0Amp of auxiliary power at 12VDC to power direct connected devices or re-power the
14 Combust.
15
- 16 P. Low Power Outputs: The system shall be capable of including up to 144 low power outputs with
17 each output able to supply 50mA at 12VDC. Outputs shall be added in increments of 16 and may
18 be added anywhere on the Combust.
19
- 20 Q. Remote Annunciation: The system shall be capable of remote zone alarm and system status
21 annunciation, up to 144 points, by adding 32 and 64 point annunciators anywhere on the Combust.
22 Annunciators shall be capable of being flush mounted. The annunciators shall provide bulls eye
23 and graphic annunciation capability.
24
- 25 R. System Software: The base panel shall come complete with all the software to implement every
26 system feature and allow the addition of every expansion or functional module without changes
27 or addition to the basic software.
28
- 29 S. System Programming:
30 1. The system shall be fully programmable via the LCD keypads and shall also allow event
31 buffer viewing via the keypads.
32 2. Separate PC based upload/download software shall allow programming and operation
33 from a directly connected local computer, or from a remote computer via a telephone
34 line or LINKS cellular communications equipment. Remote access shall be controlled
35 by the Owner to prevent unauthorized access.
36 3. All system programming shall be maintained in non-volatile memory such that program
37 information is maintained even if all AC and battery power is removed.
38

39 2.3 FIELD DEVICES 40

- 41 A. Bosch Panel zone expansion (128 zone maximum capacity required) with DSC-PC4108 zone
42 expander. DSC PTD1640U 16V power supply, minimum 12V 7A battery for main panel and one
43 for motion detection power supply panels.
44
- 45 B. Bosch System keypad (16 keypad maximum capacity required).
46
- 47 C. Maxsys 8 HDWE Zone Expander, DSC PC4108
48
- 49 D. Bravo BV-400 long range motion detectors
50
- 51 E. Bosch Tri-Motion 5 (360-degree motion detectors)
52
- 53 F. SENTROL Model 1078W magnetic door contactors for steel doors
54
- 55 G. SENTROL 2302A roll-up door contact
56

- H. Altronix AL300UL PD8CB power supply for motion detectors
- I. Batteries: 12-volt minimum 7AH for main panel and power extender panels
- J. Intercom Audio Interface: must have capacity to support up to 15 intercom stations
- K. Access Control: Provide 16 dual reader access control modules for a total of 32 readers
- L. Altronix BC100 enclosures for expansion cards.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, at all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- H. Telephone Cable: Provide a 4 pair Category 6 telephone cable from the Master Control Panel to the Telephone Equipment Room.
- I. Each motion sensor shall be an addressable zone.
- J. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring in D-rings or J-hooks. Support D-rings or J-Hooks. Cable shall be bundled on a maximum of 2'-6". D-rings or J-hooks shall be secured to the structure at a maximum of 5' on center. Bundling shall be with plenum rated cable ties. Cable shall not be directly attached to building structure.

3.2 SYSTEM OPERATION

- A. When an alarm condition is detected by any of the alarm initiating devices, the following functions shall occur:
 - 1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.

- 1 2. A custom system alarm message shall be displayed on the LCD display. This display
2 will show the alarm device location in plain English. Location and partition custom
3 messages shall be field programmable.
- 4 3. The remote signaling tie connection shall be activated at the Owner's approved central
5 security monitoring location and/or other Owner designated location.
- 6
- 7 B. Card reader access control shall be integrated with electric door hardware as required. Provide all
8 accessories for control of each individual door location indicated with card readers.
- 9
- 10 3.3 SYSTEM ZONING AND PARTITIONING
- 11
- 12 A. The system shall employ intelligent initiating devices and interface devices capable of being
13 recognized and enunciated at the main system keypad and devices partition keypad.
- 14
- 15 B. All zoning/device locations shall be field programmable.
- 16
- 17 C. Input control zones shall be as indicated on the drawings.
- 18
- 19 3.4 EXPANSION OF EXISTING SYSTEM
- 20
- 21 A. Testing of existing systems:
- 22 1. Provide complete operational test of existing security alarm system. Verify operation
23 of each device, control panel, distribution equipment and associated accessories.
- 24 2. Provide a complete written report to the Architect, indicating any deficiencies of the
25 existing system in relation to each component's intended function. In addition,
26 provide deficiencies of the existing system with regard to current Code, ADA, and
27 Local Accessibility Standards requirement. Provide the written report 14 days prior
28 to start of any work related to the expansion of the existing system.
- 29 3. Testing of the existing system shall include all areas of the main campus, remote
30 buildings and temporary buildings served by the existing system.
- 31
- 32 B. Expand the existing system to include requirements specified and as required.
- 33 1. Verify compatibility of new equipment with existing system.
- 34
- 35 3.5 COMMISSIONING THE SYSTEM
- 36
- 37 A. The installing contractor shall be responsible for verifying that each component of the system is
38 fully operational and in conformity with the specifications. He shall also be responsible for
39 insuring that all elements function together as a system in accordance with the specifications.
- 40
- 41 B. A state licensed and factory trained technical representative of the manufacturer shall supervise
42 the final control panel connections and testing of the system. Upon completion of the acceptance
43 tests, the owner and/or his representatives shall be instructed in the proper operation of the
44 system.
- 45
- 46 C. The installing contractor shall functionally test each and every device in the entire system for
47 proper operation and response. Any items found not properly installed or non-functioning shall be
48 replaced or repaired and retested.
- 49
- 50 D. The installing contractor shall provide a complete written report on the functional test of the
51 entire system. A copy of the test report shall be provided with maintenance manuals. The test
52 report shall be signed and dated by the licensed burglar alarm superintendent responsible for
53 supervising the final system test and checkout.
- 54
- 55 E. The installing contractor's burglar alarm superintendent shall test the entire system in the presence
56 of the local authorities having jurisdiction. The contractor shall be responsible for making any

changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main burglar alarm control panel.

- F. The testing and acceptance shall be performed within 30 days after the burglar alarm installation is completed. The test shall be performed by a minimum of two qualified burglar alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all burglar alarm system equipment shall include the following:
1. Burglar alarm control equipment: a visual and functional test of the burglar alarm control and auxiliary control equipment.
 2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
 3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
 4. Indicators shall be tested to ensure proper function and operation.
 5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
 6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
 7. Burglar alarm peripheral devices; All burglar alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
 8. Manual initiating devices:
 - a. Each manual alarm station at each keypad shall be functionally tested for alarm operation.
 - b. Each manual alarm station at each keypad shall be functionally tested for proper wiring supervision.
 9. Automatic initiating devices:
 - a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
 - b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
 - c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
 10. Alarm signaling devices:
 - a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation.
 - b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
 - c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
 - d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
 11. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all burglar alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory trained representative.
- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance be provided by the Owner. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

3.6 EQUIPMENT IDENTIFICATION

- 1 A. Each piece of equipment shall be provided with a permanently engraved or embossed or silk
2 screen identification tag. The tag shall include the following information:
3 1. Name of manufacturer.
4 2. Manufacturer's equipment description.
5 3. Serial number and model number.
6 4. Voltage and current rating.
7

8 3.7 SPARE PARTS AND TOOLS
9

- 10 A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the
11 corresponding components of the installed system. Spare parts shall be packaged and identified
12 by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons
13 for storage in a Contractor provided cabinet located in the building where directed by the Owner.
14 Provide a wall mounted cabinet; factory finished, keyed like the burglar alarm control panel, and
15 located in the emergency control center or as directed by Owner, Architect.
16

- 17 B. Spare Parts:
18 1. Six spare fuses of each size used in the system
19 2. Six spare detectors of each type in the system
20 3. Spare system keys (6) of each
21 4. Two copies of the final software programmed into the burglar alarm system.
22 5. Devices listed above are to be installed as directed by Architect/Engineer or local code
23 authorities at no additional cost to the Owner. Unused spare parts are to be parts for
24 Owner's cabinet.
25

- 26 C. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the
27 system recommends to be stocked for maintenance.
28

29 3.8 KEYS
30

- 31 A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type
32 required. Identify keys by an appropriate number stamped on each key or on a metal tag attached
33 thereto. Provide a key numbering chart in each operation and maintenance manual furnished.
34

35 3.9 GRAPHIC FLOOR PLANS
36

- 37 A. Provide color coded floor plan detailed with room names, graphic room numbers and adequate
38 information to direct people to the burglar alarm devices in alarm with Non-fading floor plan
39 media.
40

- 41 B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the
42 floor plan. All burglar alarm devices located to correspond with the annunciator.
43

- 44 C. The floor plan shall be solvent welded in acrylic plastic.
45 1. Mount in an extruded aluminum frame next to the main burglar alarm control panel.
46

- 47 D. Post minimum 11x17 size drawing, color laminated As-Built of system identifying all devices,
48 key pads, panels and partitions on the wall near main control panel.
49

50 3.10 ADDITIONAL REQUIREMENTS
51

- 52 A. The contractor is to ensure all areas of the egress corridors are covered with motion detectors.
53
54 B. Provide all accessories required for off-site monitoring. Coordinate with Owner for appropriate
55 off-site monitoring service.
56

- 1 C. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional
2 five (5) motion detection devices for future expansion. The initial design shall not exceed 70% of
3 the rated power supply and circuit capability.
4
- 5 D. Provide surface mount door contacts on all outside doors and roof hatch. Do not wire intrusion
6 detection devices inside door frames.
7
- 8 E. Do not place guard covers over motion detectors except in harsh environment such as gyms.
9
- 10 F. Home run all wiring devices to the control panel or zone expander; an addressable loop system is
11 not acceptable.
12
- 13 G. Alarm systems must have a dedicated 120 VAC circuit on an emergency power panel.
14
- 15 H. Intrusion detection shall be one system for entire building, armed and disarmed from any keypad
16 in the building.
17
- 18 I. The inside hallways shall have motion detectors where indicated or required to eliminate any
19 dead zones.
20
- 21 3.11 SUBSTANTIAL COMPLETION
22
- 23 A. Final acceptance of the Burglar Alarm System by the Owner, local code authorities and
24 Occupancy Permit has been issued.
25
- 26 3.12 WARRANTY
27
- 28 A. The new components and installation of the expanded burglar alarm system, including labor and
29 material, shall be free from defects in workmanship and materials, under normal use and service,
30 for a period of one year from the date of substantial completion. Any equipment or workmanship
31 shown to be defective shall be repaired, replaced or adjusted during normal working hours at no
32 cost to the owner within 4-hour notification.
33
- 34 B. Repair services and replacement parts for the system to be furnished under this Contract shall be
35 available for a period of ten years after the date of final acceptance. Service during the warranty
36 period shall be provided within four hours after notification and all repairs shall be corrected
37 within 24 hours after notification throughout the warranty specified in this section.
38
- 39 C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory
40 trained, state licensed service technicians.
41
- 42 D. The equipment manufacturer shall be represented by a local service organization and the name of
43 such shall be furnished to the Owner, Architect, and Engineer.
44
- 45 E. Provide a certified burglar alarm test of the complete system at the end of the warranty period and
46 correct any and all items to bring the system to an approved status at no cost to the Owner.
47
- 48 F. Guarantee labor, materials, and equipment provided under this contract against all defects for a
49 period of one year after the date of final acceptance and receipt and approval of "As-Built"
50 drawings and schematics of all equipment.
51
- 52 3.13 TRAINING
53
- 54 A. Provide training course to all security personnel assigned by Owner's Representative. The
55 training shall include a course syllabus and hands-on participation. Training shall be conducted

1 on a system identical to the one being installed on this project. The system shall be able to
2 perform all system operations and simulate all types or forms of alarm conditions.
3

4 B. Provide a video of the training program to the Owner's Representative to be used for periodic
5 refresher course, training of the local security department and for training of new employees.
6

7 C. The training course shall include, in addition to the above, a system overview, and a review of the
8 operation and maintenance manual.
9

10 D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the
11 installation on which instruction is to be given. The instructor shall be trained in operating theory
12 as well as in practical operation and maintenance work.
13

14 3.14 SOFTWARE
15

16 A. Provide two electronic copies of the final programming and program software to the Owner's
17 Security Supervisor after final approval.
18

19 END OF SECTION

SECTION 31 11 00 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This section pertains to the specifications for clearing and grubbing, topsoil removal and stockpiling, disconnecting, capping or sealing, and abandoning site utilities in place, and disposal of all vegetation, rubbish and excess material, as required for site grading and related staging areas as noted on the drawings and in accordance with these specifications.

1.02 DEFINITIONS

- A. Topsoil: Soil with organic content suitable for sustaining the growth of a soil stabilizing groundcover such as turf. Topsoil is spread over prepared subgrade.
 - 1. Stockpiled Native Topsoil: Topsoil stripped from the site prior to rough grading work to be spread and amended as required. No onsite soil may be used as topsoil unless approved by Landscape Architect. Soil cut from non-organic layers will not be considered for use as topsoil.
 - 2. Imported Landscape Topsoil: Off-site topsoil imported and stockpiled to be spread and amended as specified.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.
- C. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
- D. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's representative. Unauthorized excavation, as well as remedial work directed by the Owner's Rep shall be at the Contractor's expense.

1.03 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for disposal of debris.
- B. Coordinate clearing work with utility companies.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 PROJECT CONDITIONS

- A. Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-preparation operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Salvable Improvements: Carefully remove items indicated on drawings to be salvaged and store on Owner's premises where indicated. Contractor to contact Owner's representative for coordination.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place
- E. Protection of Existing Utilities:
 - 1. Existence and location of underground items are not guaranteed. Investigate and field verify before starting work. Excavation and backfill in the vicinity of existing items of work shall be carried out with extreme caution.
 - 2. Utility Locator Service: Notify Texas 811 before site clearing.
 - 3. Contractor shall be held responsible for any damage and for maintenance and protection of existing utilities.
 - 4. Indicate on record drawings where there is conflict between field conditions and drawings.
- F. Staging Areas - Approval must be obtained from the Owner to use any area for staging that is not specifically identified as such on the plans. The Contractor shall restore all areas used for staging, the extent of said restoration to be defined by the Owner upon granting approval for the use of said area for staging.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction. Restore damaged improvements to their original condition, as acceptable to Owner.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated
- D. Control dust and noise, perform work in accordance with requirement of authorities having jurisdiction. No explosives are permitted. No on-site burning is permitted.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures per Section 01 57 13 – Erosion and Sedimentation Controls.
- B. Provide measures according to a sediment and erosion control plan, specific to the site, which complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- C. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE PROTECTION

- A. Erect and maintain temporary fencing around Tree Protection Zones (TPZ) before starting site clearing. TPZ is 1.50 feet away in radial distance from the trunk for every inch in stem diameter. Remove fence when construction is complete.
- B. Do not excavate within Tree Protection Zones, unless otherwise indicated.
- C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.04 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities. Contractor is responsible for any service charge required for shut-off action. If other outstanding fees or billings are encountered, the Contractor shall notify the Owner's representative for direction.
- B. Known utilities are shown on drawings. If utilities are discovered that are not shown on the drawings, contact Owner's representative for direction. Do not interrupt unknown utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner's representative not less than two weeks in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without the authorization of the authority having jurisdiction.

3.05 CLEARING

- A. That portion of the site required for constructing the work under these specifications shall be cleared of all vegetation, such as trees, brush, grass and weeds and all other objectionable matter to the limits as depicted in the plans.
 - 1. Stumps and roots shall be removed to a depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs or to a depth of 24 inches below finished surface of required cross section for other areas.

- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.06 STRIPPING

- A. Topsoil stripping:
 - 1. Remove sod and grass before stripping topsoil.
 - 2. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. A minimum of 6 inches of soil shall be stripped. This must be verified with the geotechnical report provided by the owner for this project. If discrepancy, review with Owner prior to start of work.
 - a. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
 - 3. Strip man-made fills under structures and pavements to minimum 12" below the ground surface and dispose of all waste materials.
- B. At all times during clearing and stripping operations the area shall be kept in a manner to prevent ponding. Refer to Section 01 57 13 – Erosion and Sedimentation Control.

3.07 SITE IMPROVEMENTS

- A. Remove existing above and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion

3.08 STOCKPILING

- A. All topsoil from the stripping operations shall be stockpiled in the areas designated by the Owner's representative or shown on the drawings. Materials shall be deposited and spread in such a manner to ensure proper drainage and prevent severe erosion of the stockpile.
- B. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing.
- C. Stockpile materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles to 72 inches.
 - 2. Do not stockpile material within tree protection zones.
 - 3. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.09 DISPOSAL

- A. Subject to approval of the Owner, material from clearing operations shall be disposed of by removal from the Project site.
 - 1. Disposal of Material by Removal
 - a. Material disposed of by removal from the construction area shall be removed from the areas prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.
 - b. Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any necessary arrangements with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees or charges required to be paid for dumping of materials shall be paid by the Contractor.
 - c. In hauling any material from the site, it shall be the responsibility of the Contractor to prevent debris from dropping from vehicles and littering the site or area streets and roads. The Contractor shall promptly remove any debris which falls from vehicles.
 - d. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION 31 11 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 22 13 – SITE GRADING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section pertains to the earthwork generally consisting of excavation, filling, backfilling and subgrade preparation as required for construction of site retaining walls/structures, slab on grade walks, pavement surfaces, landscaped areas and the general shaping of the site as shown, described or reasonably inferred on the drawings.
- B. This section excludes work necessary for building pad preparations.

1.02 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.
- E. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's rep. Unauthorized excavation, as well as remedial work directed by the Owner's Rep shall be at the Contractor's expense.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- G. Unforeseen Excavation: Excavation of material, regardless of its character or nature, below the subgrade elevation required to construct the work as indicated on the drawings or specified herein.
- H. Geotechnical Engineer: Person or company contracted by the Owner and/or through the architect to provide testing and onsite Geotechnical services during the construction schedule.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction for work in the right-of-way or easements.

- C. Shoring that is required to complete the Work, is considered a method or technique and is the sole responsibility of the Contractor. If a regulatory agency requires a licensed engineer to design, approve or provide drawings for shoring, then it is the sole responsibility of the Contractor to engage the services of a qualified Engineer for shoring design services at no additional cost to the Owner.
- D. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractors own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 PROJECT CONDITIONS

- A. Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-preparation operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected.
- D. Protection of Existing Utilities:
 - 1. Existence and location of underground items are not guaranteed. Investigate and field verify before starting work. Excavation and backfill in the vicinity of existing items of work shall be carried out with extreme caution.
 - 2. Notify Texas 811 or the utility company involved to locate all public and private utility company lines before beginning work.
 - 3. Contractor shall be held responsible for any damage and for maintenance and protection of existing utilities.
 - 4. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner's Representative and the governing utility company when determinable and wait for instructions.
 - 5. For private utilities found, if it is ascertained by Owner's Representative that such utility line has been abandoned, properly cap line at a depth approved by Owner's Representative or remove line as directed. All work to cap and remove abandoned public utilities found, must be coordinated through the governing utility company.
 - 6. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and damage is caused to said utilities, Contractor shall repair, at his own expense, such damage to the satisfaction of the Owner and the Utility Company.
 - 7. Indicate on record drawings where there is conflict between field conditions and drawings.

1.05 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

- B. Samples: Submit samples of all materials used for Architect's approval wherever specified or as directed by the Architect.
- C. Shoring and Slope Protection Design:
 - 1. Prior to beginning any excavation, submit certification to the Architect that the proposed shoring and slope protection system has been accepted and approved by all governing jurisdictions. Certification shall be signed and sealed by the engineer of record for the shoring design.
 - 2. Provide signed letter from the Geotechnical Engineer stating that the proposed design complies with the recommendations of geotechnical reports.

1.06 QUALITY ASSURANCE

- A. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
- B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.
- D. Testing:
 - 1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Architect, and Contractor.
 - 2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.
 - 3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.
 - 4. All tests shall be performed by the Soil Engineer in accordance with ASTM D 1557, D1556, D2922, D3017, or other test method selected by Geotechnical Engineer.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

- A. Fill materials and sources must be approved by the Owner's Representative. The Contractor is responsible for providing adequate samples and testing results to the Owner for testing and approval.

- B. Select fill per 2.2 shall be used beneath all site retaining walls and site structures where fill material is required to achieve the grades and elevations on the plans.
- C. General fill per 2.3 shall be used for fill in landscaping areas not supporting structures. Topsoil per 2.4 shall be spread over landscape areas as needed.
- D. Fill material beneath paving shall be per 2.2 or 2.3. Regardless of the fill material used, subgrade shall be chemically stabilized for the thickness specified and detailed in the drawings.
- E. Material excavated onsite may be used as fills, with prior Geotechnical Engineer approval.
 - 1. Onsite fill materials shall be free of organic or deleterious products.
 - 2. Moisture content of existing soils may require adjustment for compaction approval.

2.02 SELECT FILL

- A. The select fill shall consist of sandy clay, lime stabilized clays or clean sand, uniformly graded and free of objectionable material.
 - 1. Sandy Clay Fill: Sandy clay fill shall have a plasticity index between 10 and 20. The fill materials shall be placed in loose lifts not exceeding 8 inches in height and compacted to 95 percent of Standard Maximum Density at the proper moisture content for that soil type as defined by ASTM D 698.
 - 2. Lime Stabilized Clay Fill: Clays may be stabilized in place or mixed with lime at another location on the site and placed and compacted. Lime stabilization shall be performed in accordance with Section 31 32 13.29 – Lime Stabilization or 31 32 13.26 – Lime-Fly Ash or Fly Ash Stabilization. The percent of lime to be used shall be determined by the testing laboratory at the source prior to acceptance of the material for fill. The material shall be placed in loose lifts not exceeding 8 inches in thickness and compacted to 95 percent of Standard Maximum Density at the proper moisture content for that soil type as determined by ASTM D 698.

2.03 GENERAL FILL

- A. General fill material shall be used for fill in landscaping areas not supporting structures, and may be used beneath pavement. General fill material may be any native soil free of debris, trash, rocks over one (1) inch in diameter and other objectionable material with a PI less than 35. General fill shall be placed and compacted in lifts not exceeding 8 inches in thickness to 95 percent standard density as defined by ASTM D 698. The fill shall be kept sufficiently low to accommodate the proper depth of topsoil and related sod or other vegetation.

2.04 TOPSOIL

- A. Topsoil material shall be native earthen material suitable for growth of vegetation such as silty and sandy loams. The site stripings may be used as topsoil unless otherwise shown on the drawings. Topsoil shall be free of roots and rocks larger than ½ inch (12 mm), subsoil, debris, large weeds and foreign matter. Topsoil shall be spread over landscape areas to a depth of 4 to 6 inches and compacted to 92 percent of standard density as defined by ASTM D 698.

2.05 SPECIAL DRAINAGE MEDIA

- A. All retaining wall and French drain backfill material shall be clean open-graded gravel, maximum 3/4" particle size in accordance with the details contained in the plans
- B. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:
 - 1. Grab Tensile Strength: 90 lbf; ASTM D 4632.
 - 2. Tear Strength: 40 lbf; ASTM D 4533.
 - 3. Puncture Resistance: 50 lbf; ASTM D 4833.
 - 4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D 4491.
 - 5. Apparent Opening Size: No. 50; ASTM D 4751.
- C. Approved Materials
 - 1. Mirafi 140 filter fabric.
 - 2. Contech C-35NW
 - 3. Approved alternate.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Inspection
 - 1. Prior to performing the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where work may properly commence.
 - 2. Verify that survey bench mark and intended elevations for the Work are as indicated.
 - 3. Verify existing grades and dimensions before starting any grading operations.
 - 4. Verify that work may proceed in complete accordance with the design.
 - 5. In the event of discrepancy, immediately notify the Owner's Representative.
- B. General
 - 1. Use all means necessary to control dust on or near the site resulting from the performance of the Work. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, adjacent uses, and concurrent work on site. Moisture level during compaction operations shall not exceed that amount as specified by Geotechnical Engineer.
 - 2. Conduct work so as to avoid injury to persons and damage to adjacent property. Provide appropriate shoring, bracing and barriers, including light when necessary.
 - 3. Coordinate operations with, and provide access to, the Geotechnical Engineer or designated representative during demolition and construction for purposes of testing, investigation and inspection.
- C. Protect and maintain benchmarks and survey control points from disturbance during construction.

- D. Protect existing site improvements to remain from damage during construction. Restore damaged improvements to their original condition, as acceptable to Owner.
- E. Locate and clearly flag trees and vegetation to remain or to be relocated
- F. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- G. Protect subgrade from excessive drying or excessive moisture.

3.02 EXCAVATION

- A. General - Contractor shall complete all excavation required regardless of the variations in hardness, type, or density of materials encountered, to the dimensions and elevations shown on the drawings. When unsatisfactory material is uncovered, that material shall be removed and replaced with select fill or treated as directed by the Owner's Representative at no additional cost to the Owner.
- B. Excavation is unclassified and includes excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remedial work due to over-excavation including provision of suitable and stable backfill meeting the degree of compaction required shall be at the Contractor's expense.
- C. If excavated materials of a suitable nature are not of sufficient quantity to complete the work, contractor may provide borrow material in sufficient quantity to complete the work with the approval of the Owner's Representative at no additional cost to the Owner.
- D. Dispose of excess satisfactory soil material and all unsatisfactory soil material and rock obtained from excavations in at no additional cost to the Owner in accordance with all local Ordinances and State and Federal Laws.
- E. Excavation for Pavement
 - 1. The material exposed after excavation shall be scarified to a depth of 6 inches and compacted to at least 95 percent of Standard (ASTM D 698) Maximum Density within plus or minus 3 percent of optimum moisture content of the soil. Where necessary to achieve the required compaction, stabilization methods as outlined in paragraph 2.2. A. 2 of this specification shall be used at no additional cost to the Owner.
 - 2. Excavation required beneath pavement sections shall comply with elevations and dimensions shown on the plans and detailed sections within a tolerance of plus or minus 0.10 foot. Contractor shall take care not to disturb areas that are designated to be protected or are outside the construction limits. Excavated areas shall be kept free of ground and surface water.
- F. Cut Slopes and Ditches: Slopes and grades of ditches shall conform to the plans within a tolerance of plus or minus 0.10 foot. No exposed slopes shall be steeper than three feet horizontal to one foot vertical. Where slope protection is specified or called out

on the plans, said protection shall be placed as soon as practical, after exposing the slope. Erosion and sedimentation controls shall be implemented in all cut areas as specified in Section 01 57 13 – Erosion and Sedimentation Control.

3.03 FILL AND BACKFILL

- A. Placement
 - 1. Fill material shall be placed in loose lifts not exceeding 8 inches for areas beneath site structures and pavement, and 12 inches for landscape areas not supporting structures. Fill areas shall be compacted to 95 percent of Standard Maximum Density at the proper moisture of that soil as defined by ASTM D 698.
 - 2. Each lift shall be thoroughly compacted and shall have obtained satisfactory density prior to proceeding with the next lift.
 - 3. The top 6 to 8 inches of material beneath vehicular pavement shall be stabilized after placement.
 - 4. Material shall be free of trash and rocks over 1 inch in diameter.
 - 5. Fill shall be brought up to the proper elevations as determined from the lines, grades, sections and elevations shown on the plans.
- B. Site Retaining Wall/Structure Backfill:
 - 1. Place granular material as engineered backfill at all building and site retaining walls.
 - 2. For precast site retaining walls, install specified gravel and filter fabric prior to backfill installation. Position according to manufacturer's recommendations.
 - 3. Place in accordance with applicable portions of the Specifications.
 - 4. Compact per approved methods, using hand operated compaction equipment. Compact to at least 90% per ASTM D1557.
- C. Compaction and Finishing
 - 1. Suitable compaction equipment commonly used to meet the requirements for this type of compaction work shall be used.
 - 2. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The surface grade shall be consistent with the drainage intent shown on the plans such that no unwanted ponding shall occur.
 - 3. Surface shall not be more than 0.10 feet above or below the established grade, and all ground surfaces shall vary uniformly between indicated grades.
 - 4. Cut material from the site may be used for fill material. Where cut material is used as fill, each lift of such material shall be properly mixed to obtain a uniform material with clay being the predominant material and maintaining a plasticity index less than 35.
 - a. Lime stabilization shall be used for clay material and shall conform to Section 31 32 13.19 – Lime Stabilization or 31 32 13.26 – Lime-Fly Ash or Fly Ash Stabilization.
 - b. Cement stabilization shall be used for sandy or silty materials and shall conform to Section 31 32 13.16 - Cement Stabilization.

3.04 EROSION CONTROL

- A. There shall be at all times adequate protection to newly graded areas to prevent soil erosion as provided in Section 01 57 13 – Erosion and Sedimentation Control.
- B. Soil erosion that occurs prior to acceptance of the work shall be repaired at no expense to the Owner.

- C. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- D. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Owner's Testing and Inspection Service; reshape and re-compact.
- E. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.05 GRADING

- A. Rough Grading
 - 1. Cut and fill shall be left sufficiently high to require cutting by fine grading.
 - 2. Grade to subgrade depths required for construction of finished surface materials and for controlled internal drainage of site.
- B. Fine Grading
 - 1. Fine grading shall conform to elevations required to ensure finished elevations as indicated on the drawings.
 - 2. At no additional cost to the Owner the Contractor shall be responsible for minor adjustments to finished grade if deemed required by the Owner's Representative.
 - 3. Provide a smooth transition between adjacent existing grades and new grades.
 - 4. Till, disc, hand rake or otherwise scarify soil removing all clods, stones, and undesirable material ½ inch or larger. Place and spread any additional material that may be required.
 - 5. Prepare to immediately begin planting operations of the completed and accepted finish grade to prevent excessive weed growth in lawn areas.
- C. Slope grades to direct water away from buildings and to prevent ponding at a minimum of 5% grade for the initial 10 feet, as shown on the drawings or as directed by the Owner's Representative. Maximum cross slope for all walkways shall be 2% for disabled access. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 0.1 foot (1.2 inches)
 - 2. Walks: Plus or minus ½ inch
 - 3. Pavements: Plus or minus ½ inch

3.06 TESTING AND INSPECTION

- A. Materials and installed work require testing to show that the specifications for the materials and work have been met. The Owner may, at the Owner's expense, take random tests on materials and installed work. The Contractor shall allow free access to material stockpiles and facilities at all times. In fill areas each lift must be tested and approved before proceeding on the next lift. Retesting of rejected materials and installed work, shall be done at the Contractor's expense.

- B. Contractor shall notify Owner's testing laboratory 24 hours in advance of beginning any earth work operations and coordinate testing schedules to meet these specifications.
- C. Maximum density tests per ASTM D 698 shall be taken on all fill materials at a rate of one test for each type of soil to be used and at least one test for every 1,000 cubic yards of fill.
- D. Field density tests per ASTM D 1556 or ASTM D 2922 shall be taken on all fill material at a rate of one test for every ten thousand 10,000 square feet and at least one test per lift.
- E. All imported fill material shall be approved prior to importing.

3.07 DUST ABATEMENT

- A. The Contractor shall comply with applicable Federal, State, and local laws and regulations concerning the prevention and control of dust pollution.
- B. During the performance of the work required by these specifications or any operations appurtenant thereto, whether on right-of-way provided by the Owner or elsewhere, the Contractor shall furnish all the labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from the contractor's operations from damaging crops, orchards, cultivated fields, and dwellings, or causing a nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from the contractor's operations under these specifications.
- C. Dust Control shall be accomplished by one of the following methods:
 - 1. Sprinkling the ground surface with water until it is moist.
 - 2. Whenever ordered by the Owner's Representative, the Contractor shall furnish and distribute over the traveled road surfaces, which have not yet been fully restored, an application of Calcium Chloride. The material used shall be Regular Flake Calcium Chloride having a minimum chemical content of Calcium Chloride of 77%. Unless otherwise specified or ordered by the Owner, rate of application shall be 3 pounds per square yard of surface covered.
 - 3. All methods of reducing formation of dust shall be at no additional cost to the Owner.

3.08 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- C. Stockpile Topsoil may not exceed 6 feet in height.

3.09 FIELD QUALITY CONTROL

- A. Testing shall be the responsibility of the Owner and costs of initial testing shall be paid by Owner. Cost of all subsequent testing necessary due to non-compliance with specifications shall be paid by Contractor.
- B. Density Test:
 - 1. Density tests shall be performed by an approved commercial testing laboratory approved per ASTM D 1557.
 - 2. Tests shall be performed in accordance with the referenced Standards.
 - 3. Field and laboratory tests for moisture density relations shall be determined in accordance with ASTM D 1557. The frequency and location of field density tests will be determined by the Geotechnical Engineer.
 - 4. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Owner.

3.10 DRAINAGE CONTROLS

- A. Provide all necessary temporary apparatus, pumps, curbs or ditches as required to divert or convey water from any source away from the Work. Do not allow water from any source to accumulate within or damage earthwork.

3.11 CLEANING AND DISPOSAL

- A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
- B. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property at no additional cost to the Owner.
- C. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 22 13

SECTION 31 23 33 – TRENCHING BACKFILLING AND COMPACTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for excavating and backfilling for storm sewer, sanitary sewer, water distribution lines, and all related appurtenances. Excavation and backfill shall be in conformance with the locations, lines, elevations and grades shown on the plans. This section also specifies the requirements for clay plugs that must be installed near building face on all utility trenches including water, storm sewer, sanitary sewer, mechanical, electrical, telecom, data, plumbing and other utility trenches for slab on grade and structural first floor building projects.

1.02 DEFINITIONS

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.
- E. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Owner's rep. Unauthorized excavation, as well as remedial work directed by the Owner's Rep shall be at the Contractor's expense.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.
- G. Utilities include underground pipes, conduits, ducts, and cables, as well as underground services within building lines.
- H. Unforeseen Excavation: Excavation of material, regardless of its character or nature, below the subgrade elevation required to construct the work as indicated on the drawings or specified herein.
- I. Bedding Material: Granular material utilized to bed piped utilities placed in trench excavations.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.

- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction for work in the right-of-way or easements.
- C. Shoring that is required to complete the Work, is considered a method or technique and is the sole responsibility of the Contractor. If a regulatory agency requires a licensed engineer to design, approve or provide drawings for shoring, then it is the sole responsibility of the Contractor to engage the services of a qualified Engineer for shoring design services at no additional cost to the Owner.
- D. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 PROJECT CONDITIONS

- A. Subsurface data is available from the Owner. Contractor is urged to carefully analyze the site conditions.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-preparation operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected.
- D. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by the Authority having Jurisdiction (AHJ) and then only after arranging to provide temporary utility services as required by the AHJ.
- E. Protection of Existing Utilities:
 - 1. Utilities have been located from surveys and available existing records; not all utilities may be shown on the Drawings. Locate all utilities prior to beginning any construction activities.
 - 2. Notify Texas 811 or the utility company involved to locate all public and private utility company lines before beginning work.
 - 3. Excavation and backfill in the vicinity of existing items of work shall be carried out with extreme caution. Contractor shall be held responsible for any damage and for maintenance and protection of existing utilities.
 - 4. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner's Representative and the governing utility company when determinable and wait for instructions.
 - 5. For private utilities found, if it is ascertained by Owner's Representative that such utility line has been abandoned, properly cap line at a depth approved by Owner's Representative or remove line as directed. All work to cap and remove abandoned public utilities found, must be coordinated through the governing utility company.
 - 6. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and damage is caused to said utilities, Contractor shall repair, at his own expense, such damage to the satisfaction of the Owner and the Utility Company.

7. Indicate on record drawings where there is conflict between field conditions and drawings.
- F. Where utilities require adjustment or relocation to construct the Work, and those utilities are shown on the Drawings, relocation or adjustment is a part of the Work and shall be completed at no additional cost to the Owner.
- G. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

1.05 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with classification according to ASTM D 2487 of each soil material proposed for backfill.
- C. Samples: Submit samples of all materials used for Owner's Representative's approval wherever specified or as directed.
- D. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.3, Materials Qualifications.

1.06 QUALITY ASSURANCE

- A. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
- B. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.
- C. Testing and Inspection Service: Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing. Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.
- D. Testing:
 1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Architect, and Contractor.
 2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.
 3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.

4. All tests shall be performed by the Soil Engineer in accordance with ASTM D 1557, D1556, D2922, D3017, or other test method selected by Geotechnical Engineer.

PART 2 – PRODUCTS

2.01 EARTH BACKFILL

- A. Earth backfill shall be native soils free of debris, trash, rocks over 1-inch in diameter and other objectionable material.

2.02 CEMENT STABILIZED SAND BACKFILL

- A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.
 1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
 2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.
- B. Cement: Type I Portland cement conforming to ASTM C 150.
- C. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank sand below, and the following requirements:
 1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.
 2. Deleterious materials:
 - a. Clay lumps, ASTM C 142 - less than 0.5 percent.
 - b. Lightweight pieces, ASTM C 123; less than 5.0 percent.
 - c. Organic impurities, ASTM C 40, color no darker than standard color.
 3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.
- D. Add required amount of water and mix thoroughly in pugmill-type mixer. This material cannot be used after it loses its moisture content.

2.03 BANK SAND BACKFILL

- A. Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:
 1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
 2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: PI not exceeding 7.

2.04 WATER

- A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
- B. Water sources other than the local municipal domestic water supply must be approved by the Owner's Representative.

- C. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words “non-potable” water.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Inspection
 - 1. Prior to performing the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where work may properly commence.
 - 2. Verify that survey bench mark and intended elevations for the Work are as indicated.
 - 3. Verify existing grades and dimensions before starting any grading operations.
 - 4. Verify that work may proceed in complete accordance with the design.
 - 5. In the event of discrepancy, immediately notify the Owner’s Representative.
- B. General
 - 1. Use all means necessary to control dust on or near the site resulting from the performance of the Work. Thoroughly moisten all surfaces to prevent dust being a nuisance to the public, adjacent uses, and concurrent work on site. Moisture level during compaction operations shall not exceed that amount as specified by Geotechnical Engineer.
 - 2. Conduct work so as to avoid injury to persons and damage to adjacent property. Provide appropriate shoring, bracing and barriers, including light when necessary.
 - 3. Coordinate operations with, and provide access to, the Geotechnical Engineer or designated representative during demolition and construction for purposes of testing, investigation and inspection.
- C. Protect and maintain benchmarks and survey control points from disturbance during construction.
- D. Protect existing site improvements to remain from damage during construction. Restore damaged improvements to their original condition, as acceptable to Owner.
- E. Locate and clearly flag trees and vegetation to remain or to be relocated
- F. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.02 EXCAVATION

- A. General
 - 1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
 - 2. Sheet piling and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five (5) feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.

3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be removed from the trench sufficiently prior to the line placing operation to insure a dry, firm bed on which to place the utility line.
 4. Excavation is unclassified and includes excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
 - a. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - b. Remedial work due to over-excavation including provision of suitable and stable backfill meeting the degree of compaction required shall be at the Contractor's expense.
 5. If excavated materials of a suitable nature are not of sufficient quantity to complete the work, provide borrow material in sufficient quantity to complete the work at no additional cost to the Owner.
 6. Dispose of excess satisfactory soil material and all unsatisfactory soil material and rock obtained from excavations in accordance with the provisions of this Section.
 7. Where utilities are in fill, compact fill material to 95% standard proctor maximum dry density at least 12 inches above the top of the proposed utility prior to excavation of trench.
 8. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Owner's Representative. Unauthorized excavation, as well as remedial work, shall be at the Contractor's expense.
- B. Sewer Trenches
1. For pipe sizes less than 30-inches in diameter, the minimum trench width shall be outside diameter of pipe plus 24-inches.
 2. For pipe sizes 30-inches in diameter and larger the minimum trench width shall be outside diameter of pipe plus 36 inches.
 3. Trenches shall be excavated to a depth at least 12-inches below the barrel of pipe, and then the pipe bedding and backfill shall be placed as shown on the appropriate details contained within the plans and as described in paragraph 3.3 A. of this section.
- C. Excavation for manholes, inlets, tie-in to existing facilities and similar structures shall be sufficient to leave at least 12-inches clear between the outer surfaces and the embankment or sheeting that may be used to hold and protect the banks. Any over depth excavation below such appurtenances shall be refilled with cement stabilized sand, as directed, at no additional cost to the Owner.
- D. Water line Trenches:
1. Water lines must be a minimum of 4-feet in depth from the top of proposed grade to the top of pipe, unless otherwise shown on the plans.
 2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 24-inches.
 3. Trenches shall be excavated to a depth of at least 12-inches below the barrel of pipe, and then the pipe bedding and backfill shall be placed as shown on the appropriate details contained within the plans and as described in paragraph 3.3 B. of this section.

3.03 PIPE BEDDING AND BACKFILL

- A. Storm and sanitary sewer trenches:
 - 1. Pipe shall be bedded and backfilled in trench in accordance with the details shown on the plans.
 - 2. Cement stabilized sand bedding shall extend from a point 12 inches below the bottom of the pipe to the level of the spring line. The cement stabilized sand shall be thoroughly rodded after being placed in trench.
 - 3. Bedding, sewer pipe and initial backfill over the top of pipe must be placed in a single day's operation for any given portion of pipe. Initial backfill shall be placed to 12-inches over the top of pipe for cement stabilized sand backfill.
 - 4. Backfill shall be placed in uniform layers not to exceed 8-inch loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D 698) at the proper moisture content specified in the Geotechnical report for this project.
 - 5. Backfill, under pavement and to 2-foot from outer edge, shall be cement stabilized sand up to 1-foot below subgrade elevation.
- B. Water line Trenches
 - 1. Pipe shall be bedded and backfilled in trench in accordance with the details shown on the plans.
 - 2. Bank sand bedding shall extend from a point 12-inches below the bottom of the pipe to the level of the spring line. The bank sand shall be thoroughly rodded after being placed in trench.
 - 3. Bedding, sewer pipe and initial backfill over the top of pipe must be placed in a single day's operation for any given portion of pipe. Initial backfill shall be placed to 12-inches over the top of pipe for bank sand backfill.
 - 4. Backfill shall be placed in uniform layers not to exceed 8-inch loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D 698) at the proper moisture content specified in the Geotechnical report for this project.
 - 5. Backfill, under pavement and to 2-foot from outer edge, shall be cement stabilized sand up to 1-foot below subgrade elevation.
- C. Bentonite Clay Plug for All Utility Trenches (water, storm, sanitary, mechanical, electrical, telecom, plumbing, etc.)
 - 1. All trenches must have a bentonite granular clay plug installed to reduce the transmission of ground water under slab on grade buildings and structural first floor buildings.
 - a. The plug must be installed at a distance of 1-foot beyond the face of the building foundation and be a minimum of 1-foot wide.
 - b. The plug must extend 6-inches beneath utility trench into undisturbed soil. This portion of the clay plug must be installed prior to the installation of the utility pipe.
 - c. The plug must extend across the entire trench width and extend 6-inches into undisturbed soil beyond the trench width. Install bentonite clay plug and the utility pipe at the same time.
 - d. The plug must extend to within 12-inches of finished grade. A clay plug cap consisting of material with a PI greater than 15 and a LL in excess of 30 shall be placed on top of the bentonite granular clay plug. This clay plug cap shall fill the remaining 12-inches up to finished grade and be placed up to the edge of the building.

3.04 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
- C. Stockpile Topsoil may not exceed 6 feet in height.

3.05 FIELD QUALITY CONTROL

- A. Testing shall be the responsibility of the Owner and costs of initial testing shall be paid by Owner. Cost of all subsequent testing necessary due to non-compliance with specifications shall be paid by Contractor.
- B. Density Test:
 - 1. Frequency and scope of testing shall be established by Geotechnical Engineer, and as required by local jurisdictional authority. If Geotechnical Engineer has not established a frequency of testing in the Geotechnical Report, testing shall be at every 100 linear foot of trench at a minimum of one per lift and a minimum of one per day.
 - 2. Tests shall be performed in accordance with the referenced Standards.
 - 3. Laboratory tests for moisture density relations shall be determined in accordance with ASTM D 1557. A minimum of one test shall be performed for each major soils type. In addition, sufficient number of retests or check points shall be performed to evaluate accuracy of maximum density values being used.
 - 4. Field in-place density shall be determined in accordance with ASTM Test Methods D 1556 or D 2922, and the moisture-density relations shall be determined in accordance with ASTM Test Method D 1557.
 - 5. Reopen improperly compacted trenches to depth directed, then refill and compact to the specified density at no additional cost to Owner

3.06 DRAINAGE CONTROLS

- A. Provide all necessary temporary apparatus, pumps, curbs or ditches as required to divert or convey water from any source away from the Work. Do not allow water from any source to accumulate within or damage trenches.

END OF SECTION 31 22 13

SECTION 31 32 13.19 – LIME STABILIZATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for treating and stabilizing existing subgrade material or select fill material under pavements or site structures as shown on the drawings, by pulverizing, adding lime, and finishing to the lines and grades shown on the drawings and constructed as specified herein.

1.02 DEFINITIONS

- A. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
- B. Backfill: Soil material or controlled low-strength material used to fill an excavation.
- C. Base Course: The layer placed between the subgrade and surface pavement in a paving system.
- D. Geotechnical Engineer: Person or company contracted by the owner and/or through the architect to provide testing and onsite Geotechnical services during the construction schedule.
- E. Moist Cure: Curing soil and lime to obtain optimum hydration.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Submit certification that hydrated lime, quicklime, or commercial lime slurry complies with specifications.
- B. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

1.05 QUALITY ASSURANCE

- A. Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing.

Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

B. Testing:

1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Architect, and Contractor.
2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.
3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.
4. All tests shall be performed by the Geotechnical Engineer in accordance with ASTM D 698, D1556, or other test method selected by Geotechnical Engineer.

PART 2 – PRODUCTS

2.01 LIME SLURRY

- A. Lime slurry for use in treating the subgrade shall conform to the chemical and physical requirements listed in Tables 1 and 2 of TxDOT Departmental Material Specification (DMS) 6350 for Commercial Lime Slurry. Lime Slurry may be prepared at the job site or other Owner approved location by using Hydrated Lime or Quicklime as specified by chemical and physical requirements in Tables 1 and 2 of TxDOT Departmental Material Specifications (DMS) 6350.

2.02 WATER

- A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
- B. Water sources other than the local municipal domestic water supply must be approved by the Owner's Representative.
- C. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words "non-potable" water.

2.03 SOIL

- A. Soil should be a clayey type soil, free of organic material, large rocks and other unsuitable materials with a plasticity index greater than 15 and a liquid limit in excess of 30. The soil should not contain more than twenty percent sands or silts.
- B. Where existing pavement or base material is encountered, pulverized or scarified material so that 100 percent of sampled material passes 2-inch sieve.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage and displacement.
- B. Verify compacted subgrade will support imposed loads.
- C. Verify subgrade lines and grades.
- D. Complete backfill of utilities prior to stabilization.
- E. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:
 - 1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.
 - 2. Provide cut to depth as specified or shown in the Drawings.
- F. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.
- G. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by the Owner's Representative, at no additional cost to the Owner.
- H. Pulverize existing material so that 100 percent passes a 1-3/4-inch sieve.

3.02 APPLICATION

- A. The percent of lime to the dry weight of the soil shall be as shown on the drawings.
- B. The lime shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry.
- C. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. The distribution of lime shall be uniformly placed in such quantity that all soil to be treated receives the minimum percentage of lime and successive passes made until the proper moisture and lime content is obtained. Limit spreading to an area where preliminary mixing operations can be completed on same working day.

3.03 MIXING

- A. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.
- B. The material and lime shall be thoroughly mixed by approved road mixers until a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps.
- C. Immediately after the "first mixing" operation, the mixture shall be brought to the proper moisture content and sealed with a light pneumatic rubber tire roller and left

to cure for 1 to 4 days, as directed by the Owner's Representative. If rework is required to obtain compaction after 72 hours of the last mixing, add 25% of the specified rate of lime.

- D. After curing time add water to bring moisture content of soil mixture to optimum or above. Mix and pulverize until all material passes 13/4-inch sieve; minimum of 85 percent, excluding non-slacking fractions, passes 3/4-inch sieve; and minimum of 60 percent excluding non-slacking fractions passes No. 4 sieve. Test according to TxDOT Tex-101-E, Part III using dry method. All clods shall be reduced in size by raking, blading, disking, harrowing, scarifying or other approved method.
- E. Shape mixed subgrade to final lines and grades.

3.04 COMPACTION

- A. Compaction of the mixture shall begin immediately after final mixing and in no case later than 3 calendar days after final mixing.
- B. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D 698 on material sample after final mix with lime.
- C. Spread and compact in two or more equal layers where total compacted thickness is greater than equipment manufacturer's recommended range of mixing and compaction.
- D. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.
- E. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.
- F. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D 698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Drawings.
- G. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

3.05 CURING

- A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.
- B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
- C. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.06 TOLERANCES

- A. Surface of the subgrade shall not show any deviation in excess of 1/4 inch above or one inch below established subgrade elevation. Thickness of the finished subgrade shall be at least the thickness shown on the plans within 1/4 inch tolerance and can exceed the thickness shown on the plans as needed to meet the needs of the project.
- B. The surface shall be uniform and smooth without large clumps or voids.

3.07 FIELD QUALITY CONTROL

- A. Testing shall be the responsibility of Owner and costs of initial testing will be paid by Owner. Cost of subsequent testing necessary due to non-compliance with Specifications shall be paid by Contractor.
- B. Test soils, lime, and mixtures as follows:
 - 1. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318, using the wet preparation method.
 - 2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.
 - 3. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.
 - 4. Moisture-density relationship will be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, Moist Preparation Method.
- C. In-place depth will be evaluated for each 5,000-square feet of subgrade and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 5,000-square feet of subgrade, 3 phenolphthalein tests will be performed. Average stabilization depth for 5,000-square feet of subgrade will be based on average depth for three tests.
- D. Perform compaction testing in accordance with ASTM D 2922. Three tests will be performed for each 5,000-square feet of subgrade.
- E. Pulverization analysis will be performed as required by Paragraph 3.03D on material sampled during mixing of each production area. Three tests will be performed per 5,000-square feet of subgrade or a minimum of once daily.

3.08 REWORK OF FAILED SECTIONS

- A. Rework sections that do not meet specified thickness.
- B. Perform the following steps when more than 72 hours have lapsed since completion of compaction.
 - 1. Moist cure for minimum of 3 days after compaction to required density.
 - 2. Add lime at rate of 25 percent of specified rate at no additional cost to City.
 - 3. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.09 PROTECTION

- A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.
- B. Repair defects immediately by replacing material to full depth.

END OF SECTION 31 32 13.19

SECTION 31 32 13.26 – LIME-FLY ASH OR FLY ASH STABILIZATION**PART 1 – GENERAL****1.01 SECTION INCLUDES**

- A. This Section specifies the requirements for treating and stabilizing existing subgrade material or select fill material under pavements or site structures as shown on the drawings, by pulverizing, adding lime and/or fly ash, and finishing to the lines and grades shown on the drawings and constructed as specified herein.

1.02 DEFINITIONS

- A. Subgrade: The uppermost surface of an excavation, including excavation for trenches, or the top surface of a fill or backfill immediately below base course, pavement, or topsoil materials.
- B. Backfill: Soil material or controlled low-strength material used to fill an excavation.
- C. Base Course: The layer placed between the subgrade and surface pavement in a paving system.
- D. Geotechnical Engineer: Person or company contracted by the owner and/or through the architect to provide testing and onsite Geotechnical services during the construction schedule.
- E. Moist Cure: Curing soil and lime to obtain optimum hydration.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Submit certification that fly ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.
- B. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

1.05 QUALITY ASSURANCE

- A. Owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soil materials to verify that soils comply with specified requirements and to perform required field and laboratory testing.

Contractor responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

B. Testing:

1. Owner will retain and pay a qualified Geotechnical engineer to take all field samples and do all laboratory testing necessary to verify compliance of the work to these Specifications or as required by City or other regulatory agencies. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Architect, and Contractor.
2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.
3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.
4. All tests shall be performed by the Geotechnical Engineer in accordance with Test Method Tex-114-E or other approved methods selected by Geotechnical Engineer.

PART 2 – PRODUCTS

2.01 LIME

- A. Lime for use in treating the subgrade shall conform to the chemical and physical requirements listed in Tables 1 and 2 of TxDOT Departmental Material Specification (DMS) 6350 for hydrated lime or quicklime. When Quicklime is selected, the Contractor is to select, prior to construction, the grade to be used and notify the Owner's Representative in writing before changing from one grade to another.

2.02 FLY ASH

- A. Fly ash to meet ASTM Specification C618-05, Class C. Fly ash, have a minimum CaO content of 20 percent and contain no lignite ash.

2.03 WATER

- A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.
- B. Water sources other than the local municipal domestic water supply must be approved by the Owner's Representative.
- C. If onsite reclaimed water sources are used, tanks and appurtenances must be clearly marked with the words "non-potable" water.

2.04 SOIL

- A. Soil should be a clayey type soil, free of organic material, large rocks and other unsuitable materials with a plasticity index greater than 10 and a liquid limit in excess of 30. The soil should not contain more than twenty percent sands or silts.

- B. Where existing pavement or base material is encountered, pulverized or scarify material so that 100 percent of sampled material passes 2-inch sieve.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage and displacement.
- B. Verify compacted subgrade will support imposed loads.
- C. Verify subgrade lines and grades.
- D. Complete backfill of utilities prior to stabilization.
- E. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:
 - 1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.
 - 2. Provide cut to depth as specified or shown in the Drawings.
- F. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.
- G. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by the Owner's Representative, at no additional cost to the Owner.
- H. Pulverize existing material so that 100 percent passes a 1-3/4-inch sieve.

3.02 APPLICATION

- A. The percent of lime and/or fly ash to the dry weight of the soil shall be as shown on the drawings.
- B. The lime and/or fly ash shall be mixed with water in trucks with approved distributors and applied as a thin water suspension or slurry.
- C. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. The distribution of lime and/or fly ash shall be uniformly placed in such quantity that all soil to be treated receives the minimum percentage of lime and successive passes made until the proper moisture and lime content is obtained. Limit spreading to an area where preliminary mixing operations can be completed on same working day.
- D. Apply lime/fly ash as single mix, single pass.

3.03 MIXING

- A. Do not expose hydrated lime and/or fly ash to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.
- B. The soil material, lime and/or fly ash shall be thoroughly mixed by approved road mixers until a homogeneous, friable mixture of material, lime and/or fly ash is obtained, free from all clods or lumps.
- C. Shape mixed subgrade to final lines and grades.

3.04 COMPACTION

- A. Compaction of the mixture shall begin immediately after final mixing and in no case later than 6 hours after final mixing.
- B. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D 698 on material sample after final mix with lime.
- C. Spread and compact in two or more equal layers where total compacted thickness is greater than equipment manufacturer's recommended range of mixing and compaction.
- D. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.
- E. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.
- F. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D 698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Drawings.
- G. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

3.05 CURING

- A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.
- B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
- C. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.06 TOLERANCES

- A. Surface of the subgrade shall not show any deviation in excess of 1/4 inch above or one inch below established subgrade elevation. Thickness of the finished subgrade shall be at least the thickness shown on the plans within 1/4 inch tolerance and can exceed the thickness shown on the plans as needed to meet the needs of the project.
- B. The surface shall be uniform and smooth without large clumps or voids.

3.07 FIELD QUALITY CONTROL

- A. Testing shall be the responsibility of Owner and costs of initial testing will be paid by Owner. Cost of subsequent testing necessary due to non-compliance with Specifications shall be paid by Contractor.
- B. Test soils, lime, fly ash and mixtures as follows:
 - 1. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318, using the wet preparation method.
 - 2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.
 - 3. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.
 - 4. Moisture-density relationship will be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, Moist Preparation Method.
- C. In-place depth will be evaluated for each 25,000-square feet of subgrade and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 25,000-square feet of subgrade, 3 phenolphthalein tests will be performed. Average stabilization depth for 25,000-square feet of subgrade will be based on average depth for three tests.
- D. Perform compaction testing in accordance with ASTM D 2922. Three tests will be performed for each 25,000-square feet of subgrade.
- E. Pulverization analysis will be performed as required by Paragraph 3.03D on material sampled during mixing of each production area. Three tests will be performed per 25,000-square feet of subgrade or a minimum of once daily.

3.08 REWORK OF FAILED SECTIONS

- A. Rework sections that do not meet specified thickness.
- B. Perform the following steps when more than 72 hours have lapsed since completion of compaction.
 - 1. Moist cure for minimum of 3 days after compaction to required density.
 - 2. Add lime at rate of 25 percent of specified rate at no additional cost to City.
 - 3. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.09 PROTECTION

- A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.
- B. Repair defects immediately by replacing material to full depth.

END OF SECTION 31 32 13.26

SECTION 31 41 33 – TRENCH SAFETY

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section is intended to provide specifications for the minimum requirements for trench safety. The Contractor shall endeavor to insure the safety of their employees working in and around trenches and other excavations in accordance with current Occupation and Safety Health Administration (OSHA) standards and in particular, Excavations, Trenching and Shoring, Federal OSHA Standards, 29 C.F.R. part 1926, Subpart P, as amended including Final Rule, published in Federal Register Vol. 54, No. 209 Tuesday October 31, 1989 and latest amendment thereto. These specifications outline minimum standards of construction safety to be followed, but should not be construed as the means, methods and operations of construction. Where the Contractor deviates from these outlined minimum standards, the Contractor is required to submit for approval by the Owner sealed engineering plans designed by a Registered Professional Engineer in the State of Texas showing the proposed method of trench protection. A copy of the approved design shall be kept at the site.

1.02 DEFINITIONS

- A. Trench: A narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet. The trench safety system requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and these installations to dimensions equivalent of a trench as defined.
- B. Trench Safety Systems: Include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.
- C. Trench Safety Program: The safety procedures governing the presence and activities of individuals working in and around trench excavations.
- D. Stable Rock - Natural solid mineral matter that can be excavated with vertical sides and remain in tract while exposed.
- E. Type A Soil – Cohesive soils with an unconfined compressive strength of 1.5 tons per square foot or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and in some cases, silty clay loam and sandy clay loam cemented soils such as caliche and hard pan are also considered Type A. However, no soil is Type A if:
 - 1. The soil is fissured.
 - 2. The soil is subject to vibration from heavy traffic, piling driving, or similar effects
 - 3. The soil has been previously disturbed.
 - 4. The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.
 - 5. The soil is subject to other factors that would require it to be classified as a less stable material.
- F. Type B Soil – Soil that meets one of the following:

1. Cohesive soil with an unconfined compressive strength greater than 0.5 tons per square foot, but less than 1.5 tons per square foot.
 2. Granular cohesionless soils including: angular gravel, silt, silt loam, sandy loam and in some cases, silty clay loam and sandy clay loam.
 3. Previously disturbed soils except those which would otherwise be classified as Type C soil.
 4. Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration.
 5. Dry rock that is not stable.
 6. Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical, but only if the soil would otherwise be classified as Type B.
- G. Type C Soil – Soil that meets one of the following:
1. Cohesive soil with an unconfined compressive strength of 0.5 tons per square foot or less.
 2. Granular soils including: gravel, sand and loamy sand.
 3. Saturated or submerged soil.
 4. Submerged rock that is not stable.
 5. Soil in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical or greater.
- H. Unconfined compressible strength shall mean the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, estimated in the field using a pocket penetrometer, or other previously approved methods.
- I. Wet soil shall mean soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

1.03 REGULATORY REQUIREMENTS

- A. Install and maintain trench safety systems in accordance with current Occupation and Safety Health Administration (OSHA) standards and in particular, Excavations, Trenching and Shoring, Federal OSHA Standards, 29 C.F.R. part 1926, Subpart P, as amended including Final Rule, published in Federal Register Vol. 54, No. 209 Tuesday October 31, 1989 and latest amendment thereto.
- B. The Contractor is responsible for obtaining a copy of OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209 section of the Federal Register.
- C. Legislation that has been enacted by the Texas Legislature with regard to Trench Safety Systems, is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., §756.021 (Vernon 1991).
- D. Reference materials, if developed for a specific project, will be issued with the Bid/Proposal Documents.

1.04 SUBMITTALS

- A. Submit a safety program specifically for the construction of trench excavation. Design the trench safety program to be in accordance with OSHA 29CFR standards governing the presence and activities of individuals working in and around trench excavations.
- B. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by Contractor.
- C. Review of the safety program by the Owner's Representative will only be in regard to compliance with this specification and will not constitute approval by the Owner's Representative nor relieve Contractor of obligations under State and Federal trench safety laws.
- D. Submit certification that trench safety system will not be subjected to loads exceeding those which the system was designed to withstand according to the available construction and geotechnical information.

1.05 INDEMNIFICATION

- A. Contractor shall indemnify and hold harmless the Owner, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgments or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.
- B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Materials used for sheeting, sheet piling, cribbing, bracing, shoring, underpinning, and other structural retaining systems shall be in good serviceable condition, of good quality, of a suitable condition and grade to perform the intended use. Wood shall be sound, free from large or loose knots, and of the proper dimensions. The Contractor shall be responsible for maintaining the systems in a manner consistent with the intended design and in a manner that will prevent exposure of workers to hazards.

PART 3 – EXECUTION

3.01 GENERAL SAFETY REQUIREMENTS

- A. The work area shall be kept free of hazards to the employees. All surface encumbrances which may create a hazard shall be removed, supported or otherwise isolated as necessary to safeguard employees.

- B. The Contractor shall take special precautions to locate existing utilities and to protect those systems as required. The Contractor shall call the Utility Coordinating Committee as required 24 hours prior to excavating around existing utilities.
- C. The Contractor shall provide safe access and egress to excavations. Ramps or stairways shall be structurally sound and capable of providing a safe means of escape from the excavation. Trenches in excess of four (4) feet in depth shall have a safe means of egress from the trench spaced such that no more than 25 feet of lateral travel would be required to reach the egress system.
- D. The employees shall be protected from work place hazards such as vehicular traffic, falling loads, and hazardous atmosphere. Excavations shall be marked so that employees and equipment are clearly warned of the location of the excavations. Trenches shall be kept free of water accumulations that would present a hazard to employees. Adjacent structures shall be stabilized as necessary so as not to present a possible hazard to the employees. Equipment shall be kept sufficiently clear of excavations so as not to create a potential overburden stress to trench walls causing cave-ins. Safe access shall be provided with handrails where access over trenches is required.
- E. Emergency rescue equipment as required by OSHA shall be readily available at the site and shall be maintained to good working condition.
- F. Daily inspections of excavations, the adjacent areas, and the protective systems shall be made by a person or persons competent to make such inspections to keep the Contractor notified of unsafe conditions so that necessary precautionary actions can be taken.

3.02 INSTALLATION

- A. Install and maintain trench safety systems in accordance with provisions of OSHA 29CFR.
- B. Install specially designed trench safety systems in accordance with the Contractor's trench excavation safety program for the locations and conditions identified in the program.
- C. A competent person, as identified in the Contractor's Trench Safety Program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

3.03 INSPECTION

- A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the trench safety systems to ensure that the installed systems and operations meet OSHA 29CFR and other personnel protection regulations requirements.
- B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until the necessary precautions have been taken by Contractor to safeguard personnel entering the trench.

- C. Maintain a permanent record of daily inspections.

3.04 FIELD QUALITY CONTROL

- A. Contractor shall verify specific applicability of the selected or specially designed trench safety systems to each field condition encountered on the project.

END OF SECTION 31 41 33

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 13 13 – CONCRETE SITE PAVING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for forming and placing reinforced vehicular pavement, curbs, sidewalks, courtyards and pedestrian areas to the lines and grades shown on the drawings and constructed as specified herein.

1.02 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.03 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Material Test Reports: From a qualified testing laboratory indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- D. Material Certificates: Signed by manufacturers certifying that each of the following materials which are part of this project, complies with requirements:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Curing compounds.
 - 5. Applied finish materials.
 - 6. Bonding agent or epoxy adhesive.
 - 7. Joint fillers.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Owner will employ a qualified independent geotechnical engineering testing agency to take all field samples and do all laboratory testing necessary to verify compliance of the work to the Specifications or as required by City or other regulatory agencies.

Contractor shall be responsible to coordinate with the testing agency prior to start of work requiring testing so as to minimize unnecessary cost or delays to the project.

C. Testing:

1. The Geotechnical Engineer shall submit results of all testing done during the course of the work to the Owner, Owner's Representative, and Contractor.
2. Notify testing lab a minimum of 48 hours in advance of the time testing is required to satisfy requirements of this section.
3. Should testing specified above show work which does not satisfy these Specifications, the Contractor shall pay, through the Owner, for all additional tests required to determine the extent of work that is not satisfactory and for all additional tests necessary to demonstrate compliance with these specifications.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement:

1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.
2. Bulk cement which meets referenced standards may be used when method of handling is approved by the Owner's Representative. When using bulk cement, provide satisfactory weighing devices.
3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by the Owner's Representative.

B. Water: Conform to requirements for water in ASTM C 94.

C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).

1. Maximum percentage by weight of deleterious substances shall not exceed following:

Item	Percent by Weight of Total Sample Maximum
Clay lumps and friable particles	3.0
Material finer than 75-µm (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All Other concrete	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

* In case of manufactured sand, when material finer than 75-µm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 1/2 inch to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1 3/4" sieve	0
Retained on 1 1/2" sieve	0 – 5
Retained on 3/4" sieve	30 – 65
Retained on 3/8" sieve	70 – 90
Retained on No. 4 sieve	95 – 100
Loss by Decantation Test (Tex-406-A)	1.0 Maximum

* In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

- D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 – 5
Retained on No. 8 sieve	0 – 20
Retained on No. 16 sieve	15 – 50
Retained on No. 30 sieve	35 – 75
Retained on No. 50 sieve	65 – 90
Retained on No. 100 sieve	90 – 100
Retained on No. 200 sieve	97 – 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.
- E. Mineral Filler: Type "C" or Type "F" fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 20 percent by weight of cementitious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.
- F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.
- G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by the Owner's Representative.

2.02 MIXING

- A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with

third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.

B. Vehicular Pavement and Curbs

1. Mix design shall have a minimum compressive strength of 3,000 pounds per square inch at 7 days and 3,500 pounds per square inch at 28 days when tested in accordance with ASTM C39. Slump of concrete shall be at least 3 inches but no more than 6 inches, when tested in accordance with ASTM C143.
 - a. Determine cement content in accordance with ASTM C 138 (water-cement ratio maximum 0.57). Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.
 - b. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.
 - c. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.
 - d. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

C. Sidewalk, Courtyard and Pedestrian Area Pavement

1. Mix design shall have a minimum compressive strength of 3,000 pounds per square inch at 28 days when tested in accordance with ASTM C39. Slump of concrete shall be at least 3 inches but no more than 6 inches, when tested in accordance with ASTM C143.
 - a. Determine cement content in accordance with ASTM C 138 (water-cement ratio maximum 0.57). Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.
 - b. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.
 - c. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.
 - d. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

D. High Early Strength Concrete

1. Use high early strength concrete pavement to limits shown on Drawings or as required to meet the project schedule. Design to meet the following:
 - a. Concrete Mix: Flexural strength greater than or equal to 500 psi at 72 hours.

- b. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.
- c. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5 inches, when tested in accordance with ASTM C 143.

E. No additional water shall be added to the concrete at the job site.

2.03 REINFORCING STEEL

- A. Provide new deformed billet steel conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.
- B. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.
- C. Welded wire fabric may only be utilized if indicated on the drawings. If wire fabric is utilized provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.
- D. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by the Owner's Representative.

2.04 ISOLATION JOINT MATERIAL

- A. Filler board of selected stock. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.
- B. Board filler shall be free of defects which will impair their usefulness as expansion joint fillers.

2.05 LOAD TRANSMISSION DEVICES

- A. Load Transmission devices shall be as detailed on plans and conform to the properties specified in ASTM A615, Grade 60 steel.

2.06 STEEL DOWEL BARS

- A. Steel dowel bars and steel reinforcement shall be deformed or smooth bars conform in properties to ASTM A 615 Grade 40. Unless otherwise shown on the plans all reinforcing steel shall be deformed bars, all dowel bars at joints shall be smooth bars, and all curb dowels shall be deformed bars.
- B. Greenstreak two component speed dowel system can be used at construction joints pending engineer approval. Product submittal required for approval.
- C. Greenstreak two component speed load system can be used at isolation joints pending engineer approval. Product submittal required for approval.

2.07 NONSHRINK GROUT

- A. Nonmetallic, nonshrink grout containing no chloride producing agents conforming to following requirements.
 - 1. Compressive strength
 - a. at 7 days: 3,500 psi
 - b. at 28 days: 8,000 psi
 - 2. Initial set time: 45 minutes
 - 3. Final set time: 1.5 hours

2.08 LIQUID MEMBRANE-FORMING COMPOUNDS

- A. Liquid membrane-forming compounds shall conform to ASTM C 309, Type 1 or Type 2, white pigmented. Membrane shall restrict loss of water to not more than 0.55 kg/m² in 72 hours using test method ASTM C 156.

2.09 COVER MATERIALS FOR CURING

- A. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.

2.10 JOINT SEALING COMPOUND

- A. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland Cement Concrete joints conforming to the requirements of TXDoT DMS-6310 for Class 5 Joint Sealants.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Verify subgrade lines and grades.
- B. The subgrade shall be a previously prepared subgrade, stabilized if required, compacted to a minimum of 95% standard density ASTM D-698, and graded to the required section and grades shown on the drawings and as specified.
- C. Proof-roll prepared sub-base surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
- D. Rolling and sprinkling shall be performed to maintain the specified moisture content of the subgrade as necessary prior to placing the concrete.

3.02 FORMS

- A. Forms shall be of wood or metal, properly treated to ensure concrete does not adhere to the forms, straight, clean, free from warp or defect, and of sufficient depth.
- B. The forms shall be so placed that when placed each form section will be firmly in contact for its whole length and base width and exactly at the established grade.
- C. Any subgrade under the forms below established grade shall be corrected using suitable material, placed, sprinkled, and rolled.

- D. Forms shall be securely staked and tightly jointed and keyed to prevent displacement.
- E. Sufficient stability of forms to support equipment operated thereon and to withstand its vibration without springing shall be required.
- F. Forms shall remain in place not less than 24 hours after concrete is placed.

3.03 JOINTS

- A. Shall be constructed in the pavement slab at locations and according to details as shown on the drawings. Stakes, braces, brackets or other devices shall be used as necessary to keep the entire joint assembly in true vertical and horizontal position.
- B. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.
- C. Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
- D. Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
- E. Form isolation joints of board filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
- F. Expansion Joints shall be constructed with board filler and sealed at top. Board filler must be perpendicular to plane of concrete slab. Alignment of joint shall not vary more than 1/4 inch in 10 feet.
- G. Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness. If applicable, match jointing of existing adjacent concrete pavement.
- H. Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 3/16-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces..

3.04 REINFORCING STEEL

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Reinforcing Steel shall be accurately placed as shown on drawings and secured in place. Wire reinforcing bars securely together at intersections and splices. All bars shall be supported on and secured to steel or plastic bar chairs. Laps shall be a minimum of ten (10) inches and tied. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed.

- C. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.
- D. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.

3.05 CONCRETE PLACEMENT

- A. Concrete not placed as herein prescribed within 90 minutes after mixing shall be rejected.
- B. Concrete shall not be placed when temperature is below 40 degrees F and falling, but may be placed when the temperature is above 35 degrees F and rising, the temperature being taken in the shade and away from artificial heat.
- C. Concrete shall not be placed before the time of sunrise, and shall not be placed later than will permit the finishing of the pavement during sufficient natural light.
- D. Moisten sub-base to provide a uniform dampened condition at time concrete is placed.
- E. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10 feet long.
- F. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.
- G. Concrete shall be consolidated by a mechanical vibrator to remove all voids. Special care shall be exercised in placing and spading concrete against forms and at all joints to prevent the forming of honeycombs and voids and to prevent displacement of steel reinforcement and load transmission devices.
- H. The concrete shall be struck off with an approved strike-off screed to such elevation that when consolidated and finished, the surface of pavement shall conform to the required section and grade. In no case shall the maximum ordinate from a 10 foot straight edge to the pavement be greater than 1/8 inch.
- I. The strike template shall be moved forward with a combined transverse and longitudinal motion in the direction the work is progressing, maintaining the template in contact with the forms, and maintaining a slight excess of material in front of the cutting edge.

3.06 FINISHING

- A. Do not add water to concrete surfaces during finishing operations.
- B. After completion of a strike-off, consolidation and transverse screeding, a hand-operated longitudinal float shall be operated to test and level the surface to the required grade. The longitudinal float shall be held in contact with the surface and parallel to the center line, and operated with short longitudinal strokes while being passed from one side of the pavement to the other. If contact with the pavement is not made at all points, additional concrete shall be placed if required, and screeded, and the float shall be used to produce a satisfactory surface.
- C. Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform texture.
 - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 - 2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
 - 3. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.07 TOLERANCES

- A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish.
- B. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.
 - 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 - 3. Surface: Gap below 10-foot long, unlevelled straightedge not to exceed 1/16 inch.
 - 4. Joint Spacing: 3 inches.
 - 5. Contraction Joint Depth: Plus 1/4 inch, no minus.
 - 6. Joint Width: Plus 1/8 inch, no minus.

3.08 CONCRETE PROTECTION AND CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures for a period of not less than 72 hours from the beginning of the curing operation.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Apply liquid membrane-forming compound in accordance with manufacturer's instructions.

- E. Moisten concrete by water fogging prior to application of membrane when surface has become dry.
- F. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by the Owner's Representative, but not less than one gallon per 200 square feet of surface area.

3.09 CURBS

- A. Dowelled on Curb
 - 1. After curing the concrete pavement, doweled on curbs, using secure forms shall be constructed to the size shown on the plans.
 - 2. Dowels may be placed in the pavement slab before the concrete has set, or placed in drilled holes using epoxy adhesive to secure the bars in place.
 - 3. Pavement joints shall extend through the curbs. Expansion joint material shall be the same thickness, type and quality as specified for the pavement.
 - 4. When sawed joints are provided, the placement of curb shall be delayed until all transverse joints are sawed.
 - 5. All joints should be tool finished after sufficient curing of the concrete.
 - 6. The concrete, reinforcement and curing of the curbs shall conform to the requirements specified for the concrete pavement.
 - 7. In finishing the curbs, a thin coating of mortar shall be worked into the exposed face of the curb in order to obtain a brush finish free of all blemishes and form or tool marks.
 - 8. Curbs shall have a straightness tolerance of 1/8 inch in 10 feet, measured longitudinally along the back and face of the curb.
 - 9. The top of the curb shall not vary vertically in height more than 1/8" when measured up from the concrete pavement.
- B. Monolithic Curbs and Curb and Gutter
 - 1. Monolithic curb and curb and gutter shall conform to the specifications for doweled on curb and the details shown on the plans.
 - 2. Monolithic curb and curb and gutter shall be constructed after final grading of the subgrade and before placement of the base material.
 - 3. These curbs shall be cured for at least 72 hours and shall be properly backfilled behind the curb by hand tamping to 95% standard proctor density ASTM D 698 before placing the base material.

3.10 APPLICATION OF JOINT SEALING COMPOUND

- A. Joints shall be thoroughly cleaned of loose scale, dirt, dust, and curing compound. When necessary, existing joint material shall be removed to the depth as shown on the plans.
- B. Joints shall be filled to the full depth of the joint opening. Pouring shall be done in a neat and workman like manner to give satisfactory results. Sufficient joint sealer shall be poured into the joints so that upon the completion of the work the surface of sealer within the joint shall be 1/4" above top of the pavement surface.

3.11 FIELD QUALITY CONTROL

- A. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of

pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Owner's Representative for high early strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Laboratory technician will prepare concrete test cylinders.

- B. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.
- C. Minimum of one 4 inch core will be taken at random locations per 5,000-square feet of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3,000 pounds per square inch.
- D. Request, at option, three additional cores in vicinity of cores indicating nonconforming in-place depths at no cost to the Owner. In-place depth at these locations shall be average depth of four cores.
- E. Fill cores and density test sections with new concrete paving or non-shrink grout.

3.12 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage.
- C. The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least 7 days old or has attained a minimum average of 3,000 psi compressive strength.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.
- E. Any damage to the pavement prior to acceptance by the Owner shall be repaired by the Contractor at no extra cost to the Owner.

END OF SECTION 32 13 13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 17 23.13 – PAINTED PAVEMENT MARKINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section pertains to the application of pavement marking as indicated on the drawings and as specified herein.

1.02 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.03 SUBMITTALS

- A. Product Data: For each type of product; include technical data and tested physical and performance properties.
- B. As requested by the Owner's Representative submit Shop Drawings for pavement markings.
 - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. As requested by the Owner's Representative submit samples for each product and for each color and texture specified; on rigid backing, 8 inches (200 mm) square.

1.04 QUALITY ASSURANCE

- A. Comply with materials, workmanship, and other applicable requirements of the Harris County Engineering Specifications latest edition for pavement-marking work.

PART 2 – PRODUCTS

2.01 CONFORMANCE OF FINISHED PRODUCTS

- A. Conformance of Finished Products. Coatings shall conform on a weight basis, to the composition requirements of the standard formula. No variation from the standard formula will be permitted except for replacement of materials lost in processing, or those approved by the Engineer. The finished coatings shall conform with all requirements stipulated for each standard formula and in addition shall equal a Wet Standard in characteristics such as color, drying, flow, settling, brush ability, can stability, hiding, etc.

- B. Film characteristics such as gloss, hardness, light permanency, adhesion, etc., shall also conform. When testing for such conformity, the coating shall be applied and tested under parallel conditions with the Wet Standard.
- C. The finished product shall be free of skins and foreign materials.

2.02 PAINTS

- A. Paint for stripping shall be 100% acrylic premium grade traffic paint conforming to the requirements of FS TT-P-1952 Type 1; latest edition.
- B. Colors shall be as shown on the Drawings or designated by the Owner's Representative from the following:
 - 1. White
 - 2. Yellow
 - 3. Blue
 - 4. Red
 - 5. Black
 - 6. Green

2.03 GLASS REFLECTIVE BEADS

- A. Glass reflective beads shall conform to the requirements of FS TT-B1325 - Type 1; latest edition.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner's Representative.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. The pavement surface to receive the striping shall be thoroughly cleaned of all dirt, organic growth, oil, grease, or other materials that will prevent adhesion of the paint to the roadway surface.

3.02 LAYOUT

- A. The pavement markings shall be placed in proper alignment with guidelines established on the roadway. Deviation from the alignment established shall not exceed 2 inches and, in addition, the deviation in alignment of the marking being placed shall not exceed 1 inch per 200 feet of roadway nor shall any deviation be abrupt.
 - 1. No striping material shall be applied over a guide cord; only longitudinal joints, existing stripes, primer, or other approved type guides will be permitted. In the absence of a longitudinal joint or existing stripe, the Contractor shall mark the points necessary for the placing of the proposed stripe. Edge striping shall be adjusted as necessary so that the edge stripe will be parallel to the centerline and shall not be placed off the edge of the pavement.

2. Longitudinal markings shall be offset at least 2-inches from construction joints of portland cement concrete surfaces and joints and shoulder breaks of asphalt surfaces.

3.03 APPLICATION

- A. Paints shall be applied by brush, spray, or flow methods to clean and dry surfaces with surface temperature 50 F or above.
- B. Traffic paint shall be applied with a minimum thickness of 10 mils, measured in dry condition, prior to adding any glass reflective spheres.
- C. Paint striping shall be applied and measured to $\pm 1/4"$ of the specified widths.
- D. Paint shall be applied as shown on drawings.
- E. Where required glass spheres or reflectorized granules shall be applied, before the paint sets or dries, evenly at a rate of 6 pounds of glass spheres or 1.7 pounds of reflectorized granules per gallon of paint.

END OF SECTION 32 17 23.13

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 32 18 16

SYNTHETIC GRASS SURFACING

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Section includes synthetic grass surfacing as indicated at exterior veterinary yard as indicated on Drawings.
- C. Related Work:
 - 01 Section 02 32 00 – Geotechnical Report
 - 02 Section 03 30 00 – Cast-In-Place Concrete
 - 03 Section 32 13 13 – Concrete Paving

1.2 SUBMITTALS

- A. Review and comply with all provisions of section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements. Include sources for component materials.
- C. Shop Drawings: Submit complete shop drawings consisting of design, fabrication, and installation of proposed assemblies.
- D. Material Certificates: Signed by manufacturer, certifying the materials and system proposed for the project comply with the specified performance criteria.
- E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
- F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
- G. Color / Finish Samples
 - 01 18 inch by 18 inch samples showing details of finished installation. Include an example of a field joined seam between adjacent rolls and outside edge attachment.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm specializing in the manufacturing of synthetic grass surfacing for a minimum of five years and who has completed work similar in design and extent to that required for the project, in not less than 15 synthetic grass dog runs in the last three years and whose work has resulted in construction with a record of successful in-service performance.
- B. Installer Qualifications: Firm experienced in the installation of synthetic grass dog runs, who is certified by the synthetic grass manufacturer to install their materials, who has successfully installed work similar in design and extent to that required for the project, in not less than 10 projects of similar scope, to the satisfaction of the Architect, in the last three years, who employs trained workmen that are experienced in the installation of the synthetic grass system proposed for the project, and whose work has resulted in construction with a record of successful in-service performance.
- C. Single-Source Responsibility: Obtain synthetic grass surfacing system materials, including drainage mat, adhesives and seaming materials, from a single manufacturer regularly engaged in manufacturing the materials.
- D. Pre-installation Conference: Prior to the start of the synthetic grass surface system work, coordinate a conference, to be held at the Site, in accordance with Section 01 31 00, Project Management and Coordination, to review the construction schedule, availability of materials, installer's personnel qualifications and experience, equipment and facilities needed to make progress and avoid delays, installation procedures, testing, inspection, and certification procedures, and coordination with other work.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site in original, unopened containers, wrapping, or packaging, with manufacturer's labels intact, identifying project, material, and production run or lot number for fabric roll.
- B. Immediately following delivery, inspect materials and components for damaged or defective items, including materials that are not uniform in color, out of tolerance regarding edge alignment and minimum pile height. Materials that are found to be damaged or defective shall be replaced at no additional cost to the Owner.
- C. Store materials in a secure, dry, well-ventilated location where protected from weather, exposure to UV, soil, dust, moisture and other contaminants. Store fabric rolls horizontally, on a flat surface.
- D. Handle according to manufacturer's recommendations to prevent damage, deterioration, distortion, or soiling.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 01 Do not install synthetic grass surfacing materials when:
 - a. Substrate surfaces/materials are wet, excessively damp, or have standing water.
 - b. Rain is imminent or forecast within 48 hours following proposed time of installation.

- c. Weather conditions, or forecasted conditions, in the opinion of the installer or manufacturer's representative, will have an adverse effect on the installation.
 - d. Humidity levels are outside of the limits recommended by adhesive manufacturer.
- 02 Install synthetic grass surfacing materials only when:
 - a. Material surface temperatures, including aggregate base materials, are above 45 degrees F, and anticipated to remain above 45 degrees F for not less than 48 hours following installation.
 - b. Ambient air temperature is 50 degrees F and rising, but not more than 95 degrees F, and forecast to remain above 50 degrees F for not less than 48 hours following installation.
 - 1) Ambient air temperatures shall be taken in the shade, away from artificial heat sources, such as exposed pavement and stone aggregate fill.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 01 Synthetic Grass Surfacing System Fabric: For repairs and/or replacement of areas displaying excessive wear.
 - a. 100 sq ft of fabric, 15 ft wide roll.

1.7 WARRANTY

- A. Warranty: Submit a written warranty for the synthetic grass surfacing system agreeing to repair or replace materials and components of the synthetic grass surfacing system that develop defects in materials or workmanship within the specified warranty period and any other deterioration of the surfacing system or evidence of failure to meet performance requirements. Defects include the following:
 - 01 Excessive Fading: Defined as the synthetic grass surfacing system shall remain a uniform color, without a change in appearance that is perceptible and objectionable, as determined by the Architect, when viewed visually in comparison with the original samples.
 - 02 Ultraviolet (UV) and heat degradation.
 - 03 Excessive Wear: Defined as the synthetic grass surfacing system pile height shall not decrease by more than 10 percent each year, or more than 50 percent within the specified warranty period beyond that attributable to normal use.
 - 04 Tuft bind loss.
 - 05 Fabric delamination
 - 06 Loss of backing integrity.
 - 07 Seam and edge raveling.
 - 08 Perimeter attachments.
 - 09 Distortion, either vertically or horizontally, due to dimensional instability.
- B. Warranty Period: 15 years from the date of Substantial Completion.
- C. The warranty shall include that if the synthetic grass surfacing system is determined to no longer be serviceable within the specified warranty period, the manufacturer and installer shall, at no cost to the Owner, remove and replace

those areas of the surfacing system not meeting the specified performance criteria for pile height and impact/shock absorption.

- D. The warranty shall not be limited by the amount of use and shall not be prorated.
- E. Provide warranty signed by the Contractor, surfacing system manufacturer, and installer.
- F. The above warranties are in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers and Systems: Subject to compliance with requirements, provide one of the following:
 - 01 Turf System
 - a. SYN Lawn Play Premium, SYNLAWN, 2680 Abutment Road, SE, Dalton, GA 30721. Phone: (866) 796-5296. (Basis of Design)
 - b. Or Approved equivalent
 - 02 Infill
 - a. Envirofil high performance Infill by US Greentech

2.2 MATERIALS

- A. The synthetic grass surfacing system shall comply with the following:
 - 01 Fall Rating: 10'-0".
 - 02 Linear Density: Not less than 5,040 Denier; ASTM D 1557.
 - 03 Pile Weight: Total pile weight 80 oz/sq yd; ASTM D 5848.
 - 04 Primary Backing Weight: 8 oz/sq yd; ASTM D 5848.
 - 05 Secondary Backing Weight: Average 20 oz/sq yd; ASTM D 5848.
 - 06 Total Weight: 104 oz/sq yd; ASTM D 5848.
 - 07 Tuft Bind: Not less than 8 lbs; ASTM D 1335.
 - 08 Flame Resistance: Pass; ASTM D 2859.
 - 09 Drainage Through Fabric: Not less than 30 inches per hour; ASTM F 1551.
 - 10 Lead Content: Comply with ASTM F 2765 for maximum lead content. Meet all federal and state heavy metal compliance standards.
 - 11 Yarn:
 - a. Field: Polyethylene with HeatBlock.
 - b. Trim: Texturized Polypropylene.
 - 12 Yarn Length:
 - a. Field: 1-1/2 inches long, nominal.
 - b. Trim: 1-1/4 inch long, nominal, +/- 15 percent.
 - 13 Color:
 - a. Field: Green Lime.
 - b. Trim: Tan.
- B. Accessories:
 - 01 Perimeter Board: Wood and plastic composite materials made from reclaimed wood fibers and reclaimed or recycled thermoplastic polymer plastic material.

- 02 Foam Pad: Recycled closed cell polyethylene foam pad with drainage channels on the bottom of the pad. Density of pad as recommended by synthetic grass manufacturer.
 - a. ThermaGreen
 - b. Or other as recommended by grass surfacing manufacturer.
 - 03 Infill: infill for synthetic turf system to be non-toxic, reusable with anti-microbial protection.
 - a. Materials: Silicon Dioxide, Pigment and Acrylic
 - b. Roundness: krumbien shaped meeting ISO1 3503-2/API RP19C
 - c. Non-Flammable to meet ASTM E648
 - d. Anti-microbial Protection
 - 04 Provide all additional materials, equipment and accessories necessary for a complete installation as recommended by the manufacturer. Included are all perimeter fasteners, backings, tools, labor, equipment, and means for protection of adjacent surfaces and materials.
- C. Fabrication:
- 01 Fabric Rolls: Fabricate synthetic grass fabric in strips, 15 ft wide by length required to extend completely across the grass surfacing area, without intermediate cross seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine area to receive synthetic grass surfacing system, with installer present, for compliance with manufacturer's requirements and other conditions affecting performance.
 - 01 Verify the finish elevations, slopes, and planarity of the base comply with requirements of the Project and surfacing system manufacturer.
 - 02 Record findings, prepare a written report, signed by Contractor and installer, and submit copies of report to the Architect and the Owner.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of existing conditions.
- C. Install at locations shown on the drawings.
 - 01 Install at the main courtyard as part of Alternate.

3.2 PREPARATION

- A. Thoroughly clean the area to receive the synthetic grass system of foreign material and all other substances and materials that may be detrimental to permeability and/or installation of the synthetic grass system.

3.3 INSTALLATION

- A. General: All work shall be performed by skilled workmen, who are experienced and trained by the manufacturer in the installation of the synthetic grass system. Work shall be performed in accordance with the Drawings, reviewed shop drawings, and manufacturer's written installation instructions.
- B. Synthetic grass surfacing fabric rolls shall be unrolled and allowed to relax prior to installation.

- C. Install synthetic turf over 4" min layer of crushed aggregate as recommended by manufacturer to provide drainage and fall protection requirements.
- D. Fabric Roll Installation:
 - 01 Install perimeter boards as recommended by the surfacing system manufacturer, including board attachment fasteners.
 - 02 Attach the foam pad to the perimeter boards with glue as recommended by the surfacing system manufacturer.
 - 03 Synthetic grass surfacing fabric rolls shall be installed across entire width of area, parallel to long dimension, or as directed by the Architect.
 - a. Rolls shall extend from edge to edge. Cross seams are not allowed.
 - b. Rolls shall be rolled out in same direction and installed with uniform pile direction of fibers.
 - c. Rolls shall be laid straight and true to line. Adjacent rolls, when laid together, shall form a tight-fitting seam for the entire length of the fabric. Fitted pieces are not allowed.
 - 04 Spot glue the surfacing fabric to the foam pad as recommended by the surfacing system manufacturer.
- E. Seaming of Fabric:
 - 01 Seams in the synthetic grass fabric rolls shall be glued together with seaming cloth, utilizing the manufacturer's standard seaming procedures and materials, ensuring that each roll is properly attached to the next.
 - a. Seams shall be flat, tight, and permanent, with no separation or fraying.
 - b. Seams, when completed, shall display no visible signs of joining, with fibers brushed to provide full coverage of fibers over the seam.

3.4 CLEANING AND PROTECTION

- A. The installer shall keep the site clean and clear of debris throughout the project. Waste materials, including excess materials remaining after completion of the Work, shall be removed, and legally disposed of offsite.
- B. Installer shall provide all labor, supplies, and equipment required to completely remove stains and other blemishes from all finished surfaces.
- C. Provide protection over installed synthetic grass surfacing systems, including closing the area to traffic, as required to ensure installed system will be free of damage at time of Substantial Completion.

3.5 INSPECTION

- A. Inspection: After installation is complete, the synthetic grass surfacing system installer, synthetic grass surfacing system manufacturer's representative, and Architect shall inspect the installation. Any corrections shall be noted in a written report and completed prior to Substantial Completion.

3.6 DEMONSTRATION AND TRAINING

- A. Train Owner's staff regarding maintenance and repair/replacement of the synthetic grass surfacing system, and maintenance. Training dates and times shall be coordinated by the Owner.

- B. All training shall be completed prior to Substantial Completion of the project.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

CONDITIONS OF THE CONTRACT, TOMBALL ISD RFP, SECTIONS AA THROUGH CD AND DIVISION 1 APPLY TO THIS SECTION.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Refer to Tomball ISD RFP #950-23 – Procurement and Contracting Requirements and Division 1 – General Requirements including Section 012500 – Request for Substitution Procedures.
- B. Scope of Work:
 - 01 Provide chain link fencing in heights and at locations / configurations as indicated on the Drawings.
 - 02 Provide single and double chain link gates where indicated on the Drawings.
- C. Related Work:
 - 01 Section 03 30 00 – Cast-In-Place Concrete
 - 02 Section 32 13 13 – Concrete Paving

1.1 SUBMITTALS

- A. Review and comply with all provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Submit manufacturer's literature, product data, certifications and supporting information for all products proposed to be furnished, as necessary to demonstrate compliance with the specified requirements.
- C. Shop Drawings: Submit complete Shop Drawings consisting of design, fabrication, and erection / installation of proposed assemblies.
 - 01 Show profiles, sizes, spacing and locations of assembled components.
 - 02 Show details of shop fabrications, connections, and details.
 - 03 Show details of field fabrications, connections, and details.
- D. Site Plan Drawings:
 - 01 Site plan (and more detailed plan where necessary) showing layout of all proposed chain link fencing and gates.
 - 02 Indicate height, size, material, and finish.
 - 03 Include details of post anchoring / footings, joints, attachments and clearances of all components.
- E. Installation Instructions: Submit manufacturer's complete installation instructions, including fastening, for all products and / or assemblies proposed to be furnished.
 - 01 Installation details submitted for review shall be specific to the Work of this Contract and accurately depict interface within the assembly(s) indicated on the Drawings.
 - 02 Generic details that do not depict actual conditions shall not be acceptable.

- F. Maintenance Instructions: Submit manufacturer's complete maintenance instructions and recommendations for all products and / or assemblies proposed to be furnished.
 - 01 Include recommended cleaning products and instructions for use.
 - 02 Where applicable, provide recommended maintenance schedules and procedures.
- G. Color / Finish Samples:
 - 01 Provide two (2) samples of each finish for selection by the Architect.
 - 02 Finish samples shall be provided of / on actual material; paper or digital samples shall not be accepted.
 - 03 Minimum size shall be 3" x 3" but must be large enough to convey attributes of the proposed product.

1.2 REFERENCES

- A. American Society for Testing Materials:
 - 01 ASTM A90 – Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - 02 ASTM A153 / A153M-16 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 03 ASTM A653 / A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 04 ASTM A924 / A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 05 ASTM F668 – Polyvinyl Chloride (PVC)-Coated Steel Chain Link Fence Fabric
 - 06 ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
 - 07 ASTM F1043 - Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
 - 08 ASTM F1664 - Standard Specification for Polyvinyl Chloride (PVC)-Coated Steel Tension Wire Used with Chain Link-Fence.
- B. Chain Link Fence Manufacturers Institute "Industrial Steel Specifications for Fence Posts, Gates and Accessories".

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain Link Fabric: (PVC Coated)
 - 01 Diamond mesh (2 inch), helically-woven and inter-woven.
 - 02 Class 2A – Extruded and bonded.
 - 03 Wire Size: Minimum 9-gauge copper bearing steel wire, hot dip galvanized. Gauge does not include PVC coating.
 - 04 Wire Tensile Strength: 70,000 PSI.
 - 05 Twisted and barbed (double knuckle) finished at top and bottom selvages (no exposed barbs).
 - 06 Attach chain link fabric with black 9-gauge galvanized tie wire to all rails at 18" O.C. maximum intervals.

- B. Framing:
- 01 All pipe components shall be fabricated from Schedule 40 steel pipe; unless noted otherwise.
 - 02 All components shall be hot dip galvanized.
 - 03 All rails shall be located toward the inside of the site.
- C. Fence Posts:
- 01 Posts for fences 7'-0" or less:
 - a. Line: 2-3/8" O.D.
 - b. Terminal / End / Corner: 2-7/8" O.D.
 - 02 Posts for fences 7'-1" to 10'-0":
 - a. Line: 2-7/8" O.D.
 - b. Terminal / End / Corner: 3-1/2" O.D.
 - 03 Line posts for fences 10'-1" or greater:
 - a. Line: 2-7/8" O.D.
 - b. Terminal / End / Corner: 4" O.D.
 - 04 Provide conical tops at all posts, firmly secured in place.
- D. Top and Bottom Rail:
- 01 Continuous top rail: 1-5/8" O.D. minimum.
 - 02 Continuous bottom rail: 1-5/8" O.D. minimum. Provide at all fences taller than 6'-0".
 - 03 At fences without bottom rail, stretch minimum 9-gauge bottom tension wire taut between terminal posts. Securely anchor to each intermediate post 6 inches above grade and secure to fence fabric with hog rings at 24" O.C.
- E. Mid Rails and Truss Braces:
- 01 Continuous mid rail: 1-5/8" O.D. minimum. Provide at all fences 8'-0" tall or taller.
 - 02 Provide 5/16" truss rod and turnbuckle between terminal posts and adjacent posts.
 - 03 Where required for stability and rigidity, provide 1-5/8" O.D. diagonal truss members between terminal posts and line posts.
- F. Tension Bars and Wire:
- 01 Tension bars shall be minimum 5/8" flat bar. Connect chain link fabric to terminal posts with tension bands; 12" O.C. maximum spacing.
- G. Swing Gates - ASTM F900:
- 01 General: Gate frames shall be constructed of 2" round steel tubing of the sizes listed below.
 - 02 Person swing gates shall be joined at the corners by arc welding to form a rigid, one-piece unit and filled with specified chain link fabric to match the fence. Hot-dip galvanize after fabrication.
 - 03 Fasten fabric to the frame on all four sides by means of adjustable hook bolts and tension rods. Equip all gates with galvanized steel hinges and latch.
 - 04 Gate leaf width 3'-0" to 5'-0": 2-1/4" O.D. 4.1 PLF, ASTM A120, galvanized schedule 50 pipe or 2-1/2 inch X 2-1/2 inch roll section, ASTM A501, hot dipped galvanized.
 - 05 Gate leaf width 8'-0" to 11'-0": 4" O.D. 9.11 pounds per foot, ASTM A120, galvanized schedule 50 pipe or 3" x 3" roll section, ASTM A501.
 - 06 At double leaf gates, provide a crane bolt drop rod to secure one leaf. Provide a receiver in ground for drop rod. Imbed receiver in concrete.

minimum of 6" diameter by 12" deep. Provide a clip to secure the drop rod in the raised position when the leaf is open.

- H. Swing Gate Hardware:
- 01 Hinges: Provide male / female post type hinges.
 - a. Two (2) per gate up to 72".
 - b. Three (3) hinges per gate 72" (+).
 - c. Where designated, provide self-closing spring hinge(s).
 - 02 Standard Latches: Fork type latch capable of accepting (owner furnished) pad lock.
 - 03 Self-Closing Gate Latches: Provide self-latching latch capable of accepting (owner furnished) pad lock.
 - 04 Double Leaf Gate Latches: Provide 2-piece, heavy duty double-fork latch with 6" legs and slotted receiver; capable of accepting (owner furnished) pad lock.
 - 05 Crane Bolts / Drop Rods: At double leaf gates, provide a crane bolt drop rod to secure one leaf.
 - a. Provide a receiver in ground for drop rod. Imbed received in concrete minimum of 6" diameter by 12" deep.
 - b. Provide a clip to secure the drop rod in the raised position when the leaf is open.
- I. Swing Gates with Exit Devices:
- 01 Coordinate with hardware supplier for exact requirements of gate components for proper interface with exit device.
 - 02 Self-closing hinges capable of latching exit device.
 - 03 Exit Device Housing: Provide minimum 6"H x 2-1/2" D x 1/4" steel plate C-shape section welded continuous to gate frame at each end.
 - 04 Strike Plate: Provide minimum 1/4" thick steel plate on fixed fence section as required to mount exit device strike receiver mechanism.
 - 05 Where shown, provide minimum 12 gauge expanded metal sections welded to gate / fence components as required to prevent access to exit device controls.
- J. Polyvinyl Chloride (PVC) Coating:
- 01 Chain link fabric and associated wiring to be Class 2b PVC, 22 mil coating per ASTM F668 and ASTM F1664.
 - 02 Rails, posts and other non-wire components shall have a bonded PVC coating to give equivalent performance to chain link fabric, per ASTM F1043.
 - 03 All none fabric components shall be finished with a minimum of 2 mils of epoxy paint per manufacturer's standards.
 - 04 Color: As selected by Owner from manufacturer's full range of standard colors.
- K. Privacy Slats: Polyvinyl Chloride (PVC) Coating:
- 01 Provide privacy slats for all chain link fencing at the perimeter of the property. Slats to be full height of fence and width to fit fence fabric.
 - 02 Material: PVC.
 - 03 Color: As selected by Owner from manufacturer's full range of standard colors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Spacing:
 - 01 Space line posts at 8'-0" O.C. maximum.
 - 02 Space pull posts where grade changes more than 30-degree slope.
- B. Footings:
 - 01 Line Posts: Set in minimum 12" diameter concrete footing a minimum of 24" post embedment in concrete, with a minimum 3" concrete cover at the bottom.
 - 02 All terminal, corner, and pull posts: Set in minimum 12" diameter concrete footing a minimum of 36" inch post embedment in concrete, with a minimum 3" concrete cover at the bottom.
 - 03 Concrete footing sizes and depths are based on holding top of footings +/- 4" below finish grade. Concrete exposed at finish grade shall not be accepted.
 - 04 All concrete shall be 3,000 psi minimum (28 days), pea gravel aggregate.
 - 05 Refer to Section 03 30 00 – Cast-In-Place Concrete for additional information and requirements.
- C. Install all chain link fencing and gates in strict accordance with Chain Link Manufacturers Institute recommendations.
 - 01 Stretch fabric to proper tension between terminal posts and securely fasten to frame. Bottom of fabric shall be held as uniformly as practical to the finished grade.
 - 02 Fasten chain link fabric securely to terminal posts with 3/16" x 3/4" tension bars and 11-gauge tie wires, spacing not to exceed 14 inches apart.
 - 03 Tie fabric to rails with 9-gauge tie wires, spacing not to exceed 18" O.C.
- D. Gates (Swing): Install plumb and level. Adjust hardware for smooth operation.

END OF SECTION

SECTION 32 92 00 – TURF AND GRASSES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section pertains to the establishment of vegetative cover by hydromulching or sodding as indicated on the drawings and as specified herein.

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.
- E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.
- B. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.
- C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.
- D. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.05 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.
 - 1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

PART 2 – PRODUCTS

2.01 HYDROMULCH

- A. Seed: Conform to U.S. Department of Agriculture rules and regulations of Federal Seed Act and Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:
 - 1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.
 - 2. Bermuda: Extra-fancy, treated, lawn type common bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.
 - 3. Wet, moldy, or otherwise damaged seed will not be accepted.
 - 4. Seed requirements, application rates, and planting dates are:

TYPE	APPLICATION RATE (Lb/Ac)	PLANTING DATE
Hulled Common Bermuda Grass 98/88	40	Jan 1 to Mar 31
Unhulled Common Bermuda Grass 98/88	40	
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda Grass 98/88	40	Oct 1 to Dec 31
Unhulled Common Bermuda Grass 98/88	40	
Annual Rye Grass (Gulf)	30	

- B. Shall be 13-13-13 grade, pelleted, uniform on composition, free-flowing, and suitable for application with approved equipment. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws, and bearing the name or trademark and warrant of the producer.
- C. Wood Cellulose fiber mulch, for use with the hydraulic application of grass seed and fertilizer, shall consist of specially prepared wood cellulose fiber. It shall be processed in such a manner that it will not contain germination of growth inhibiting factors. It shall be dyed a green color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows

infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field testing of their product has been accomplished and that meets all of the foregoing requirements.

- D. Soil Stabilizer: "Terra Tack 1" or approved equal.
- E. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

2.02 SOD

- A. Species: Bermuda (Cynodon Dactylon), Buffalo (Buchloe Dactyloides), or St. Augustine (Stenotaphrum Secundatum) Gulf Coast variety to match existing sod or as indicated on the Drawings.
- B. Contents: 95 percent permanent grass suitable to climate in which it is to be placed; not more than 5 percent permanent weeds and undesirable grasses; good texture, free from obnoxious grasses, roots, stones and foreign materials.
 - 1. Sod shall be rejected if found to contain any amount of the following weeds:
 - a. Quackgrass.
 - b. Johnson grass.
 - c. Poison ivy.
 - d. Nimbleweed.
 - e. Thistle.
 - f. Bindweed.
 - g. Bentgrass.
 - h. Perennial sorrel.
 - i. Bromegrass.
- C. Size: 12 inch wide strips, uniformly 2 inches thick with clean-cut edges. Rhizome development should be apparent.
- D. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.

2.03 TOP DRESS FERTILIZER

- A. (Delayed Application) Complete fertilizer, fifty (50%) percent of the nitrogen to the derived from natural organic sources or urea-form. Available phosphoric acid shall be from superphosphate, bond, or tankage. Potash shall be derived from muriate of potash containing sixty (60%) percent potash:
 - 1. 16% Nitrogen
 - 2. 6% Phosphoric Acid
 - 3. 8% Potash

PART 3 – EXECUTION

3.01 PREPERATION

- A. Verify that grades are within 1-inch plus or minus the required finished grades. Verify that all soil preparation has been completed and approved. Report all variations in writing.
- B. Stones, Weeds, Debris: Verify that all areas to receive lawns and grasses are clear of stones larger than 1/2 inch in diameter, weeds, debris, and other extraneous materials.
- C. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, restore areas if eroded or otherwise disturbed after finish grading.
- E. Contractor shall obtain approval of hydromulch area preparation from the Owner's Representative prior to beginning turf establishment.

3.02 SODDING

- A. Sod Bed Preparation:
 - 1. Rolling: Roll amended soil with 200 pound water-ballast roller.
 - 2. Moistening Soil Surface: After all unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.
 - 3. Timing: Sod immediately thereafter, provided the sod bed has remained in friable condition.
- B. Sodding Operations :
 - 1. Big roll sod shall be installed by tractors with proper flotation tires or by an approved big roll sod installation machine. Care should be taken to roll out sod at a proper speed so that no humping or tearing of sod occurs. Sod will be manually pulled together by stiff rakes to insure no gaps remain in the seams. Joints should be staggered. Damaged or problem areas shall be cut out and replaced in a professional manner.
 - 2. Starter Strip:
 - a. Lay first row of sod in a straight line, with subsequent rows parallel to and tightly against each other.
 - b. Stagger lateral joints.
 - c. Do not stretch or overlap sod.
 - d. Butt all joints tightly to eliminate all voids.
 - 3. Cutting: Use a sharp knife to cut sod to fit curves, surface components of the irrigation system or other items.
 - 4. Tamping and Rolling: Thoroughly tamp and roll sod to make contact with sod bed. Roll each entire section of completed sod.
 - 5. Watering: Thoroughly water sod immediately after installation to wet the underside of the new sod pad and the soil immediately below to a depth of 6 inches. Maintain constant moisture for 2 weeks or until sod is fully rooted.
 - 6. Top-Dress Fertilizer: Apply at the rate of (6) to (8) pounds per 1,000 square feet at 25 days and at 50 days after sodding.

3.03 HYDROMULCH SEEDING

- A. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.
- B. Mixing: Care shall be taken that the slurry preparation should be accomplished per the material supplier's recommendations and the equipment manufacturer's written operations manual. Spraying shall commence immediately when the slurry is mixed and the tank is full. The operator shall spray the area with a uniform, visible coat by using the green color of the wood pulp as a guide.
- C. Keep hydromulch within areas designated and keep from contact with other plant material.
- D. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.
- E. After application, the Contractor shall not operate any equipment over the covered area.
- F. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.
- G. Refer also to the maintenance portion of this section.
- H. All areas designed on drawings shall be covered uniformly with specified materials using hydromulching processes. If surfaces remain uncovered within the designated area, the Contractor shall seed with required grasses or ground cover materials those areas missed by the hydromulch application. Method used to seed these missed surfaces shall be an alternate seeding operation approved by the Architect/Engineer/Owner's Representative and shall be accomplished at no additional cost to the Owner.

3.04 MAINTENANCE

- A. The Contractor shall provide full maintenance by skilled employees of the landscape installer to maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.
- B. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:
 - 1. Seeded Lawns: 90 days from date of planting completion.
 - 2. For areas seeded in fall or if lawn is not fully established, continue maintenance following spring until acceptable lawn is established.
 - 3. Sodded Lawns: 30 days from date of planting completion.
- C. Repair areas damaged by erosion by regrading, rolling and replanting.

- D. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydromulch.
- E. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing.

3.05 WARRANTY

- A. Time Period: Warrant that lawns are in healthy and flourishing condition of vigorous active growth one year from date of Final Acceptance.
- B. Appearance During Warranty: Lawns shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.
- C. Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.
- D. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or Acts of God during Warranty Period. Report such conditions in writing.

3.06 FINAL ACCEPTANCE

- A. Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:
 - 1. For Seed: Ninety Five (95%) percent uniform coverage of grass in excess of one (1") inch height. No bare spots of greater than two (2) square feet will be accepted.
 - 2. For Sod: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. The Owner's Representative shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

END OF SECTION 32 92 00

SECTION 33 10 00 – WATER DISTRIBUTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for furnishing and installing water lines, laterals, stubs, and appurtenances for both potable and non-potable water distribution systems. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.02 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- B. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.
- C. Regulatory Requirements for potable water systems:
 - 1. Contractor shall comply with requirements of utility company supplying water; including tapping of water mains and backflow prevention.
 - 2. Contractor shall comply with standards of authorities having jurisdiction for potable water service piping, including materials, installation, testing, and disinfection.
- D. Regulatory Requirements for Non-potable water systems:
 - 1. The system shall be comprised of purple components. Use purple colored pipe, Pantone 522 embossed or integrally stamped/marked in English and in Spanish "CAUTION RECLAIMED WATER DO NOT DRINK" and "AGUA DE RECUPERACIÓN - NO BEBER".
 - 2. A minimum of an eight inch by eight-inch sign, in English and Spanish, is prominently posted on/in the area that reads "Reclaimed Water – Do not drink" and "AGUA DE RECUPERACIÓN - NO BEBER" on the storage tank of such non-potable system if within the construction site.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

- C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- C. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- E. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping.[Include marking "NSF-pw" on piping.]
 - 2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

PART 2 – PRODUCTS

2.01 PVC PIPE

- A. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
- B. Bear National Sanitation Foundation Seal of Approval (NSF-PW).
- C. Pipe 3-inch diameter and less: PVC I.P.S. ASTM D2241, SDR 26; SDR 21 as alternate to offset pipe sections or for construction within 9 feet of any existing or proposed sanitary sewer; nominal 20-foot lengths; cast-iron equivalent outside diameters.
- D. Pipe 4-inch through 12-inch: AWWA C 900, DR 18; DR 14 as alternate to offset pipe sections or for construction within 9 feet of any existing or proposed sanitary sewer; nominal 20-foot lengths; cast-iron equivalent outside diameters.
- E. Pipe 14-inch through 20-inch: AWWA C 905; 235 psi; DR 18; nominal 20-foot lengths; cast iron equivalent outside diameter.
- F. Gaskets:
 - 1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
 - 2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
 - 3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

- G. Do not use PVC in potentially or known contaminated areas.
- H. Do not use PVC in areas exposed to direct sunlight.
- I. Make curves and bends by bending the pipe, do not exceed maximum limits of curvature recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by the Owner's Representative

2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform to AWWA C115, C150 and C151 and bear mark of Underwriters' Laboratories approval. Unless otherwise shown on Drawings, use minimum Pressure Class 250 for water lines or thickness Class 52 for water lines in casing or augured hole. Provide minimum Pressure Class 350 for flanged pipe.
- B. Provide standard outside coating with cement mortar lining to AWWA C 104 standards.
- C. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.
- D. Provide flange adapter with insulating kit as required when connecting new piping to existing piping and piping of different materials, unless otherwise approved by the Owner's Representative.
- E. No welding will be permitted on Ductile Iron Pipe except at restrained joint spigots. No field welding is allowed.
- F. Gaskets
 - 1. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material in accordance with ANSI A21.11 or ASTM F 477 (One Bolt only); for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.
 - 2. For Pipes to be installed in contaminated areas, use gaskets as recommended by the Pipe Manufacturer, and approved by the Owner's Representative prior to installation.
- G. All ductile iron pipe and fittings shall be wrapped with polyethylene per AWWA C 105.

2.03 JOINTS

- A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.16 flanged end. Provide push-on restrained joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, conform to requirements of AWWA C111; provide minimum 304 stainless steel for restraint joints.
- B. Where required by Drawings, provide approved restrained joints for buried service.
- C. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.
- D. Provide for restrained joints designed to meet test pressures required under 3.8 of this Section. Provide restrained joints for test pressure or maximum surge pressure

as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.

2.04 FITTINGS

- A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they connect to.
- B. Fittings shall conform to AWWA C 153, latest edition, pressure rated at 250 psi and shall be fusion bonded epoxy lined or cement mortar lined. Unless otherwise noted on the drawings or required by the authority having jurisdiction provide mechanical joint fittings.
- C. Mechanical Joint Fittings: ANSI A 21.11; pressure rated at 250 psi.
- D. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psi.

2.05 GATE VALVES

- A. Gate Valves 2 inches in diameter: Iron body resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.
- B. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), 200 psi pressure rating, bronze mounting, mechanical joint ends with rubber joint rings, and nut-operated unless otherwise specified.
- C. Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; mechanical joint ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psi pressure rating.
- D. Gate Valves Extension Stem: Provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.
- E. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.
- F. The operating nut shall be 2-inch square and shall have an arrow, cast in the metal, indicating the counter-clockwise direction of opening.
- G. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.
- H. Provide flanged joints when valve is connected to steel or PCCP.
- I. Key valve stem into the operator nut.

- J. Unless otherwise specified, all gate valves shall be installed complete with valve box.
- K. Do not exceed 600 ft-lbs of torque on operator nut on gate valve.

2.06 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves:
 - 1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
 - 2. Branch Outlet of Tapping Sleeve:
 - 3. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.
 - 4. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
 - 5. Use cast iron split sleeve where fire service from 6-inch water line is approved.
- B. Tapping Valves: Meet requirements of 2.05 above with the following exceptions:
 - 1. Inlet Flanges:
 - 2. AWWA C 110; Class 125.
 - 3. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.
 - 4. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.
 - 5. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

2.07 VALVE BOXES

- A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.
- B. Cast letter "W" into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.
- C. Unless otherwise specified, uncoated cast iron.
- D. Riser Pipe.
 - 1. Provide 6-inch PVC, DR 18, riser pipes in accordance with 2.01 above.
 - 2. 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with 2.02 above.
 - 3. Provide single section of pipe.
- E. Concrete for valve box placement:
 - 1. For locations in new concrete pavement, provide strength and mix design of new pavement.
 - 2. For other locations, provide concrete for sidewalks conforming to requirements of Section 32 13 13 Concrete Paving.

2.08 FIRE HYDRANTS

- A. Fire hydrants shall be Mueller Super Centurion or an approved equivalent.
- B. Each hydrant shall be factory tested to a hydrostatic pressure of 300 psi with valve in both the open and closed positions. The direction of opening nut shall be counterclockwise and shall be cast on the head of the hydrant. Hose nozzles shall be

bronze or non-corrosive metal and threads shall be national standard. The main valve opening shall be either five and one fourth (5 1/4) inches in diameter or six and one fourth caps shall be provided with gaskets. Bury length shall be three and one half (3 1/2) feet unless otherwise noted on the plans. Hydrants shall be provided with "dry top" which prevents stem threads from contacting water, and "break off" type barrel and stem.

- C. Hydrants shall be painted with shop coating in accordance with AWWA C502 specification. Final coats of paint will be applied by Contractor in accordance with the requirements of the authority having jurisdiction.
- D. Contractor shall verify and provide nozzle threads consistent with the requirements of the authority having jurisdiction.

2.09 MANUFACTURERS

- A. Use approved American manufacturers.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage and displacement.
- B. Verify all existing utilities prior to beginning construction. Inform the Owner's Representative if existing utilities are not as shown in the plans.
- C. Water service to the site or adjacent landowners shall not be shut down without prior approval of the Owner's Representative and the authority having jurisdiction. At no additional cost to the Owner the Contractor shall install necessary valves so as not to disrupt service outside limits of water lines to be lowered/relocated whether or not indicated on the plans.
- D. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes or separation of four feet minimum from force mains in all directions. Where above clearances cannot be attained, provide protection per the requirements of the drawings and obtain additional instructions as required from the Owner's Representative before proceeding with construction.

3.02 GENERAL

- A. Unless otherwise specified, the provisions of this section shall conform to AWWA C600 and C605, latest editions.
- B.

3.03 CLEANING AND INSPECTION

- A. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed,

clean inside of pipe and remove debris. The interior of the pipe shall be kept clean throughout the duration of the work.

- B. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.04 EARTHWORK

- A. Conform to applicable provisions of Section 31 23 33 Trenching, Backfilling and Compaction.
- B. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- C. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.
- D. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.05 PIPE CUTTING

- A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the Owner's Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.06 LOWERING/RELOCATING EXISTING WATER LINES

- A. Water lines to be lowered/relocated shall not be shut down without prior approval of the local governing agency.
- B. Whether or not indicated on the plans, any existing water lines that are in conflict with proposed utilities shall be the lowered/relocated as necessary to facilitate construction, at no additional cost to the Owner.
- C. Contractor shall install necessary valves so as not to disrupt service outside limits of water lines to be lowered/relocated whether or not indicated on the plans.
- D. Whether or not indicated on the plans, the lowered/relocated water line shall have minimum of four (4) feet of cover. Location shall be a minimum distance from existing location as necessary to facilitate construction.
- E. If the lowered/relocated water lines are of potable water systems, they shall be required to meet same hydrostatic and sterilization test results as new water lines.
- F. Installation of lowered/relocated water lines shall meet the same requirements of new water lines as in paragraph 3.07 below.

3.07 PIPING INSTALLATION

- A. General Requirements:
 - 1. Lay pipe in subgrade free of water.
 - 2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
 - 3. For potable water line installation, when a water line is being installed parallel to a sanitary sewer, a horizontal distance of separation of nine (9) feet (outside to outside) must be maintained.
 - 4. A minimum clearance of 12" must be maintained between water lines and all other utility lines.
 - 5. For potable water line installation, when a water line is to be installed such that it will cross over an existing or proposed sanitary sewer, a section of pipe at least 18' long of either ductile iron or PVC pipe C-900 DR-18 shall be installed such that it will be centered over the sanitary sewer. Water lines shall in no case be installed below a sanitary sewer.
 - 6. Properly form bedding to fully support bell without wedging or blocking up bell.
 - 7. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade trench to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than 500 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.
- B. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.
- C. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to connecting to or shutting down existing water line. Provide the authority having jurisdiction and the Owner's Representative a minimum of two weeks notice prior to connecting to or shutting down existing water line.
- D. Make curves and bends as recommended by manufacturer and approved by the Owner's Representative.
- E. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer.
- F. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.
- G. Every valve, including bypass valves, shall be provided with a valve box. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut, with the cover flush with the pavement surface or such other level as directed.
- H. Hydrants shall be located as shown on the Plans and in a manner that will provide complete accessibility and will prevent damage from vehicles. All hydrants shall stand plumb and shall have their pumper connections at right angles to the street.

- I. Minimum cover on water lines shall be 48 inches unless otherwise specified, but in no case shall the top of any water line be less than 24 inches below the finished ground surface.

3.08 JOINTS AND JOINTING

- A. Rubber Gasketed Bell-and-Spigot Joints:
 1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
 2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
 3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
 4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
 5. Use restrained joints as shown on Drawings.
 - a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
 - b. Do not include passive resistance of soil in thrust restraint calculations.
 6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by the Owner's Representative.
- B. Restrained Joints
 1. Installation.
 - a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
 - b. Examine and clean mechanism; remove dirt, debris and other foreign material.
 - c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
 - d. Verify gasket is evenly seated.
 - e. Do not over stab pipe into mechanism.
 2. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
- C. All bends, tees, valves, and plugs shall have thrust blocks installed in accordance with the details on the plans. Thrust blocking will be installed such that joints will be accessible for inspection and repair. Concrete used in thrust blocking shall have a compressive strength of at least 3,000 psi and conform to the requirements of Section 32 13 13 Concrete Paving.

3.09 HYDROSTATIC TESTING OF WATER LINES

- A. After the pipe has been laid and initial backfill completed, the water line shall be subjected to a hydrostatic test per AWWA C600 or AWWA C605 at a minimum pressure of 150 psi. Joints shall remain exposed during testing whenever possible.
- B. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test. The meters

used in the testing shall be tested, sealed and approved at the Contractor's expense prior to running any test.

C. Procedure

1. Where practicable, pipelines shall be tested in lengths between valves or plugs of no more than 1,500 feet. Contractor must have written approval for test sections greater than 1,500 feet.
2. Minimum duration of testing for each section shall be 2 hours when joints are exposed and 8 hours when joints are covered.
3. Allowable leakage shall be as calculated by the following formula:
$$L = (S)(D) (P^{.05}) / 133,200$$

L= Allowable leakage in gallons per hour
S=Length of Pipe in Feet
D=Inside diameter of pipe in inches
P=Pressure in pounds per square inch
4. Correct defects, cracks, or leakage by replacement of defective items. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered shall be replaced, regardless of total leakage shown.
5. Repeat test until satisfactory results are obtained.
6. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

3.10 DISINFECTION OF WATER LINES

- A. Promptly disinfect water lines after approved completion of the hydrostatic tests.
- B. Contractor shall pay for and provide water for disinfection and flushing.
- C. Contractor will conduct disinfection operations.
- D. Coordinate chlorination operations with the authority having jurisdiction and the Owner's Representative.
- E. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to the existing water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.
- F. Use fire hydrants as blow-offs to flush newly constructed water lines 6 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves as approved by the Owner's Representative and remove promptly upon successful completion of disinfection and testing.
- G. Slowly fill each section of pipe with water in manner approved by Owner's Representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.
- H. Backfill excavations immediately after installation of risers or blow-offs.

- I. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.
- J. Procedure
 - 1. Use not less than 100 parts of chlorine per million parts of water.
 - 2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
 - 3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.
 - 4. Open and close valves in lines being sterilized several times during contact period.
 - 5. After disinfection and flushing of water lines, the Contractor shall have bacteriological tests performed by an approved testing laboratory. When test results indicate need for additional disinfection of water lines based upon Texas Commission on Environmental Quality and/or Texas Department of Health requirements, provide additional disinfection operations.
 - 6. Upon satisfactory completion of testing, remove temporary risers remaining disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION 33 10 00

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 33 30 00 – SANITARY SEWER

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for furnishing and placing sanitary sewer pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.02 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
 - 1. Contractor shall comply with requirements of utility company receiving waste water. Include tapping of existing structures or service lines.
 - 2. Contractor shall comply with standards of authorities having jurisdiction for sanitary sewer piping, including materials, installation and testing.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- C. Install sewer lines to meet minimum separation distance from potable water line, as shown in the drawings. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as shown in the drawings.
- D. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- B. Contractor is responsible for protecting materials per manufactures recommendations
 - 1. Do not store plastic manholes, pipe, and fittings in direct sunlight.
 - 2. Protect pipe, pipe fittings, and seals from dirt and damage.
 - 3. Handle precast structures according to manufacturer's written rigging instructions.
- C. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe to-manhole connections.

PART 2 – PRODUCTS

2.01 PVC PIPE

- A. PVC pipe for gravity sanitary sewers shall conform to ASTM D3034, SDR 26. All diameters shall use bell and spigot ends for gasketed joints. For sewers up to 12" diameter crossing over or under waterlines, provide minimum 150 psi pressure-rated pipe conforming to ASTM D2241 with suitable PVC couplings.
- B. PVC pipe for sanitary sewer force mains shall conform to ASTM D2241, SDR 21 or AWWA C 900, DR 18 and provide a minimum pressure rating of 150 psi. Pipe shall be green in color.
- C. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
- D. Do not use PVC in potentially or known contaminated areas.
- E. Do not use PVC in areas exposed to direct sunlight.
- F. Make curves and bends by bending the pipe, do not exceed maximum limits of curvature recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by the Owner's Representative.

2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe for gravity sanitary sewers shall conform to ASTM A746, thickness Class 50, pressure rated for 150 PSI unless otherwise indicated on the plans. Pipe shall be lined with 20 mils of epoxy extending from plain or beveled end to rear of gasket socket. The exterior of the pipe shall have a bituminous coating approximately one mil in thickness.
- B. Ductile iron pipe for sanitary sewer force mains shall conform to ASTM C151, thickness Class 50, pressure rated for 150 PSI. Pipe shall be lined with 20 mils of epoxy extending from plain or beveled end to rear of gasket socket. The exterior of the pipe shall have a bituminous coating approximately one mil in thickness.
- C. Gaskets shall conform to AWWA C111, rubber.
- D. All ductile iron pipe and fittings shall be wrapped with polyethylene per AWWA C 105.

2.03 JOINTS

- A. PVC pipe joints shall conform to ASTM D3212 with a SDR matching the pipe.
- B. Ductile iron pipe joints shall be push-on type unless otherwise indicated on the plans.

2.04 MANHOLES

- A. Precast concrete manholes in accordance with the details shown on the Drawings shall conform to ASTM C-478.
- B. Cast-in-Place-Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated. The minimum compressive strength of concrete manhole shall be 4,000 psi.
- C. Ballast: Increase thickness of concrete as required to prevent flotation.
- D. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.
- E. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
- F. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
- G. All manholes shall have stainless steel manhole inserts (inflow preventers).

2.05 MORTAR

- A. Mortar for construction of the bench and invert in all manholes shall conform to ASTM C 476.

2.06 CLEANOUTS

- A. Cleanouts in accordance with the details shown on the Drawings shall consist of PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.07 RIMS, GRATES AND FRAMES

- A. Castings for manhole rims, covers and frames shall conform to ASTM A 48, Class 35B gray iron or better quality.

2.08 FITTINGS

- A. Fittings shall be mechanical joint conforming to AWWA C153 lined with 20 mils of epoxy extending from plain or beveled end to rear of gasket socket. The exterior of the fitting shall have a bituminous coating approximately one mil in thickness.
- B. Gaskets shall conform to AWWA C111, rubber.

- C. All ductile iron fittings shall be wrapped with polyethylene per AWWA C 105.

2.09 MANUFACTURERS

- A. Use approved American manufacturers.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage and displacement.
- B. Verify all existing utilities prior to beginning construction. Inform the Owner's Representative if existing utilities are not as shown in the plans.
- C. Perform work in accordance with OSHA standards.
- D. Sewer service to the site or adjacent landowners shall not be shut down without prior approval of the Owner's Representative and the authority having jurisdiction. At no additional cost to the Owner the Contractor shall install necessary piping and accessories so as not to disrupt service outside to other facilities or landowners whether or not indicated on the plans.
- E. Confirm that nine feet minimum separation from water lines and accessories. Where above clearances cannot be attained, provide protection per the requirements of this Section and obtain additional instructions as required from the Owner's Representative before proceeding with construction.
- F. Before installation, inspect each pipe, fitting and structure for defects. Reject defective, damaged or unsound pipe, fittings or structures and remove them from site.

3.02 GENERAL

- A. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of the trench has been properly shaped.
- B. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.
- C. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream. Establish required uniform line and grade in trench from benchmarks identified by the Owner's Representative. Use laser beam equipment to establish and maintain proper line and grade of work.
- D. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.

- E. A minimum clearance of twelve (12) inches must be maintained between the sewer and all other lines. Sanitary sewers shall not be routed over water lines.
- F. Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps and suitable means such as well points or pervious underdrain bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation. Care should be taken that any underdrain is of proper gradation and thickness to prevent migration of material between the underdrain, pipe embedment and native soils in the trench below and at the sides of the pipe.
- G. Do not allow sand, debris, runoff or other foreign materials to enter sewer system.

3.03 DIVERSION PUMPING

- A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from the Owner's Representative.
- B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.
- C. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage and promptly notify the Owner's Representative.

3.04 EARTHWORK

- A. Conform to applicable provisions of Section 31 23 33 Trenching, Backfilling and Compaction.
- B. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- C. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.
- D. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.05 PIPE CUTTING

- A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the Owner's Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.06 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- E. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.
- F. Provide lubricant, place and drive home newly laid sections so as to eliminate damage to sections. Install pipe to "home" mark where provided.
- G. Keep excavations free of water during construction and until final inspection.
- H. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- I. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full 20 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 10 feet on each side of crossing.
- J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 1 foot separation distance.

3.07 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. Contractor shall utilize methods of pipe installation other than open cut as shown on the Drawings or as otherwise required to install the sewer.
- B. Pipe shall be of the size, type, and class specified on the Plans, or other types as may be specified by the Engineer or designated on the Plans.
- C. Jacking
 - 1. If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner satisfactory to the Owner's Representative to prevent earth caving.
 - 2. Where pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by jacking or boring methods, construction shall be made in such a manner that will not interfere with the operation of the railroad, street, highway, or other facility, and shall not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the Owner's Representative, until such time as the backfill has been completed and then shall be removed from the site.

3. Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head, usually of timber, and suitable bracing between jacks and jacking head shall be provided so that pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe. In general, embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the embankment with jacks, into the space thus provided.
4. The Contractor shall furnish for the Owner's Representative's review, a plan showing his proposed method of handling, including the design for the jacking head, jacking support of back stop, arrangement and position of jacks, pipe guides, etc., complete in assembled position. The review of this plan by the Owner's Representative's will not relieve the Contractor from his responsibility to obtain the specified results.
5. The excavation for the underside of the pipe, for at least one third of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of not more than two inches (2") may be provided for the upper half of the pipe. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the pipe. The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but it shall not exceed two feet (2') in any case. This distance shall be decreased on instructions from the Engineer, if the character of the material being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.
6. The pipe, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established will be permitted at the discretion of the Owner's Representative provided that such variation shall be regular, only in one direction and that the final grade of flow line shall be in the direction indicated on the plans.
7. If the Contractor desires, he may use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with inside angles or lugs to keep the cutting edge from slipping back onto pipe.
8. When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
9. Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at no additional cost to the Owner.
10. The pits or trenches excavated to facilitate jacking operations shall be backfilled in accordance with the details for backfilling sewer lines shown in the Drawings immediately after the jacking of the pipe has been completed.

D. Boring

1. The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation of shoring shall be as outlined above under 3.5.C. The location of the pit shall meet the approval of the Owner's Representative. The holes are to be bored mechanically. The boring shall be done using a pilot hole. By this method approximately a two inch (2") pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit.

2. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Jetting will not be permitted.
3. In unconsolidated soil formations a gel forming colloidal drilling fluid consisting of at least 10% of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter.
4. Allowable variation from line and grade shall be as specified under 3.5.C. above. Over cutting in excess of one inch (1") shall be remedied by pressure grouting the entire length of the installation.

3.08 MANHOLES

- A. Manholes shall be constructed at locations shown on the plans and to the depth indicated thereon.
- B. Manholes shall be constructed to the dimensions shown on the plans. Where concrete or precast concrete sections are used, the interior wall shall be coated with 80 mils thickness Raven 405.
- C. Joints between precast concrete sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.
- D. The construction of manholes shall be done as soon as practical after sewer lines into or through the manhole are completed.
- E. All sewers shall be cut neatly at the inside face of the walls of the manhole and pointed up with mortar.
- F. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.
- G. The inverts of the sewer line or several sewer lines entering the manhole at or near the flow line elevation of the manhole shall be shaped and routed across the floor of the manhole using mortar to obtain the proper contour.
- H. When sanitary sewer pipes enter a manhole two (2) feet or greater above the bottom of the manhole, a drop pipe of equal diameter shall be constructed outside the manhole to the bottom of the manhole per the details on the plans.
- I. All Manholes are to be backfilled per the details shown in the Drawings and the requirements of Section 31 23 33 – Trenching, Backfill and Compaction.

3.09 FRAMES, GRATES, RINGS AND COVERS

- A. Casting shall conform to the type shown on the Drawings and shall be clean castings, free from sand or blow holes or other defects. Materials shall be not less than Class 30B gray iron conforming to ASTM A-48.
- B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.
- C. Bearing surfaces between manhole rings and covers and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

3.10 INSPECTION AND TESTING OF GRAVITY SANITARY SEWERS

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- B. Do not put into service before inspection and approval.
- C. Test completed piping systems according to requirements of this section and authorities having jurisdiction.
- D. Schedule tests and inspections by the Owner's Representative and authorities having jurisdiction with at least 48 hours' advance notice.
- E. Submit separate report for each test.
- F. Sanitary Sewer Cleaning and Television Inspection
 - 1. Cleaning:
 - a. Take precautions to protect sanitary sewer mains and manholes from damage that might be inflicted by the improper selection of cleaning processes or improper use of equipment. When using hydraulically-propelled devices take precautions to ensure that the water pressure created does not cause damage to or flooding of public or private property. Do not surcharge any sanitary sewer to an elevation that could cause overflow of sewage into area waterways, homes or buildings, or onto the surface.
 - b. Exercise care to prevent contamination of the potable water system. Use an appropriately sized backflow preventer as required by the authority having jurisdiction when drawing water from a public hydrant.
 - c. Debris Disposal: Remove sludge, soil, sand, rocks, grease, roots and other solid or semi-solid material resulting from the cleaning operation at the downstream manhole of the section being cleaned. Passing debris from any sewer section to any other sewer section is not allowed. Load debris from the manholes into an enclosed container permitted for liquid waste hauling. Remove solids and semi-solids resulting from cleaning operations from the site and dispose of lawfully at the end of each work day. Do not accumulate debris, liquid waste, or sludge on the site.
 - 2. Television Inspection
 - a. Immediately after cleaning, video inspect the sanitary sewer line to document the condition of the line. Notify the Owner's Representative 48

hours in advance of any television inspection so that they may observe inspection operations.

- b. Perform television inspection on one manhole section at a time. Adequately control the flow in the section being inspected. No flow is allowed in the line while performing post-installation video inspection.
- c. Perform television inspection of sanitary sewers as follows:
- d. Videos shall pan all manholes showing benches, walls, annular spaces, and debris removal. Camera operator shall slowly pan each service connection, clamped joint and pipe material transition from one material to another. Complete and submit a Television Inspection Report for every sewer segment video submitted to the Owner's Representative.
- e. Provide a video showing the completed work including the condition of any service connections. Prepare and submit Television Inspection Report forms providing the location of service connections along with the location of any discrepancies.
- f. Document results of video inspections using a Television Inspection Report form approved by the Owner's Representative.

G. Sanitary Sewer Deflection Testing

1. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
2. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing.
3. Pull approved mandrel by hand through sewer sections. Mandrel testing is not required for stubs.
4. Document results of deflection testing using a Sanitary Sewer Deflection Test Report form approved by the Owner's Representative.

H. Sanitary Sewer Leakage Testing

1. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed below.
 - a. Low Pressure Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
 - b. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.

- c. Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria.

	$T = 0.0850(D)(K)/(Q)$
T =	time for pressure to drop 1.0 pounds per square inch gauge in seconds
K =	0.000419 DL, but not less than 1.0
D =	average inside diameter in inches
L =	length of line of same pipe size in feet
Q =	rate of loss, 0.0015 ft ³ /min./sq. ft. internal surface

- d. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given below.
- e. For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.
- f. Document results of low pressure air test using a Sanitary Sewer Low Pressure Air Test Report form approved by the Owner's Representative.

Notes:

- When two sizes of pipe are involved, compute time by ratio of lengths involved.
- Lines with 27-inch average inside diameter and larger may be air tested at each joint.
- Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
- If joint test is used, perform visual inspection of joint immediately after testing.

I. Sanitary Manhole Vacuum Testing

1. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
2. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.
3. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
4. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified below.
5. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury (Hg).
6. Document results of vacuum testing using a Sanitary Sewer Manhole Vacuum Test Report form approved by the Owner's Representative.

3.11 INSPECTION AND TESTING OF SANITARY SEWER FORCE MAINS

A. Hydrostatic Testing

1. After the pipe has been laid and initial backfill completed, the water line shall be subjected to a hydrostatic test per AWWA C600 or AWWA C605 at a minimum pressure of 150 psi. Joints shall remain exposed during testing whenever possible.
2. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test. The meters used in the testing shall be tested, sealed and approved at the Contractor's expense prior to running any test.
3. Where practicable, pipelines shall be tested in lengths between valves or plugs of no more than 1,500 feet. Contractor must have written approval for test sections greater than 1,500 feet.
4. Minimum duration of testing for each section shall be 2 hours when joints are exposed and 8 hours when joints are covered.
5. Allowable leakage shall be as calculated by the following formula:
$$L = (S)(D)(P.05) / 133,200$$

L= Allowable leakage in gallons per hour
S=Length of Pipe in Feet
D=Inside diameter of pipe in inches
P=Pressure in pounds per square inch
6. Correct defects, cracks, or leakage by replacement of defective items. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered shall be replaced, regardless of total leakage shown.
7. Repeat test until satisfactory results are obtained.
8. Upon satisfactory completion of testing, plug openings in force main. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

B. Pigging Test

1. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.
2. Pigs: Provide proving pigs manufactured of open-cell polyurethane foam body, without coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of nominal cross-sectional area of pipe. Pigs shall be able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to force main being tested.

END OF SECTION 33 30 00

SECTION 33 30 00 – SANITARY SEWER

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for furnishing and placing sanitary sewer pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.02 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with all current, applicable codes and regulations.
 - 1. Contractor shall comply with requirements of utility company receiving waste water. Include tapping of existing structures or service lines.
 - 2. Contractor shall comply with standards of authorities having jurisdiction for sanitary sewer piping, including materials, installation and testing.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- C. Install sewer lines to meet minimum separation distance from potable water line, as shown in the drawings. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as shown in the drawings.
- D. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- B. Contractor is responsible for protecting materials per manufactures recommendations
 - 1. Do not store plastic manholes, pipe, and fittings in direct sunlight.
 - 2. Protect pipe, pipe fittings, and seals from dirt and damage.
 - 3. Handle precast structures according to manufacturer's written rigging instructions.
- C. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe to-manhole connections.

PART 2 – PRODUCTS

2.01 PVC PIPE

- A. PVC pipe for gravity sanitary sewers shall conform to ASTM D3034, SDR 26. All diameters shall use bell and spigot ends for gasketed joints. For sewers up to 12" diameter crossing over or under waterlines, provide minimum 150 psi pressure-rated pipe conforming to ASTM D2241 with suitable PVC couplings.
- B. PVC pipe for sanitary sewer force mains shall conform to ASTM D2241, SDR 21 or AWWA C 900, DR 18 and provide a minimum pressure rating of 150 psi. Pipe shall be green in color.
- C. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
- D. Do not use PVC in potentially or known contaminated areas.
- E. Do not use PVC in areas exposed to direct sunlight.
- F. Make curves and bends by bending the pipe, do not exceed maximum limits of curvature recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by the Owner's Representative.

2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe for gravity sanitary sewers shall conform to ASTM A746, thickness Class 50, pressure rated for 150 PSI unless otherwise indicated on the plans. Pipe shall be lined with 20 mils of epoxy extending from plain or beveled end to rear of gasket socket. The exterior of the pipe shall have a bituminous coating approximately one mil in thickness.
- B. Ductile iron pipe for sanitary sewer force mains shall conform to ASTM C151, thickness Class 50, pressure rated for 150 PSI. Pipe shall be lined with 20 mils of epoxy extending from plain or beveled end to rear of gasket socket. The exterior of the pipe shall have a bituminous coating approximately one mil in thickness.
- C. Gaskets shall conform to AWWA C111, rubber.
- D. All ductile iron pipe and fittings shall be wrapped with polyethylene per AWWA C 105.

2.03 JOINTS

- A. PVC pipe joints shall conform to ASTM D3212 with a SDR matching the pipe.
- B. Ductile iron pipe joints shall be push-on type unless otherwise indicated on the plans.

2.04 MANHOLES

- A. Precast concrete manholes in accordance with the details shown on the Drawings shall conform to ASTM C-478.
- B. Cast-in-Place-Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated. The minimum compressive strength of concrete manhole shall be 4,000 psi.
- C. Ballast: Increase thickness of concrete as required to prevent flotation.
- D. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.
- E. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
- F. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
- G. All manholes shall have stainless steel manhole inserts (inflow preventers).

2.05 MORTAR

- A. Mortar for construction of the bench and invert in all manholes shall conform to ASTM C 476.

2.06 CLEANOUTS

- A. Cleanouts in accordance with the details shown on the Drawings shall consist of PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.07 RIMS, GRATES AND FRAMES

- A. Castings for manhole rims, covers and frames shall conform to ASTM A 48, Class 35B gray iron or better quality.

2.08 FITTINGS

- A. Fittings shall be mechanical joint conforming to AWWA C153 lined with 20 mils of epoxy extending from plain or beveled end to rear of gasket socket. The exterior of the fitting shall have a bituminous coating approximately one mil in thickness.
- B. Gaskets shall conform to AWWA C111, rubber.

- C. All ductile iron fittings shall be wrapped with polyethylene per AWWA C 105.

2.09 MANUFACTURERS

- A. Use approved American manufacturers.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage and displacement.
- B. Verify all existing utilities prior to beginning construction. Inform the Owner's Representative if existing utilities are not as shown in the plans.
- C. Perform work in accordance with OSHA standards.
- D. Sewer service to the site or adjacent landowners shall not be shut down without prior approval of the Owner's Representative and the authority having jurisdiction. At no additional cost to the Owner the Contractor shall install necessary piping and accessories so as not to disrupt service outside to other facilities or landowners whether or not indicated on the plans.
- E. Confirm that nine feet minimum separation from water lines and accessories. Where above clearances cannot be attained, provide protection per the requirements of this Section and obtain additional instructions as required from the Owner's Representative before proceeding with construction.
- F. Before installation, inspect each pipe, fitting and structure for defects. Reject defective, damaged or unsound pipe, fittings or structures and remove them from site.

3.02 GENERAL

- A. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of the trench has been properly shaped.
- B. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.
- C. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream. Establish required uniform line and grade in trench from benchmarks identified by the Owner's Representative. Use laser beam equipment to establish and maintain proper line and grade of work.
- D. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.

- E. A minimum clearance of twelve (12) inches must be maintained between the sewer and all other lines. Sanitary sewers shall not be routed over water lines.
- F. Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps and suitable means such as well points or pervious underdrain bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation. Care should be taken that any underdrain is of proper gradation and thickness to prevent migration of material between the underdrain, pipe embedment and native soils in the trench below and at the sides of the pipe.
- G. Do not allow sand, debris, runoff or other foreign materials to enter sewer system.

3.03 DIVERSION PUMPING

- A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from the Owner's Representative.
- B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.
- C. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage and promptly notify the Owner's Representative.

3.04 EARTHWORK

- A. Conform to applicable provisions of Section 31 23 33 Trenching, Backfilling and Compaction.
- B. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- C. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.
- D. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.05 PIPE CUTTING

- A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the Owner's Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.06 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- E. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.
- F. Provide lubricant, place and drive home newly laid sections so as to eliminate damage to sections. Install pipe to "home" mark where provided.
- G. Keep excavations free of water during construction and until final inspection.
- H. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.
- I. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full 20 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 10 feet on each side of crossing.
- J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 1 foot separation distance.

3.07 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. Contractor shall utilize methods of pipe installation other than open cut as shown on the Drawings or as otherwise required to install the sewer.
- B. Pipe shall be of the size, type, and class specified on the Plans, or other types as may be specified by the Engineer or designated on the Plans.
- C. Jacking
 - 1. If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner satisfactory to the Owner's Representative to prevent earth caving.
 - 2. Where pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by jacking or boring methods, construction shall be made in such a manner that will not interfere with the operation of the railroad, street, highway, or other facility, and shall not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the Owner's Representative, until such time as the backfill has been completed and then shall be removed from the site.

3. Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head, usually of timber, and suitable bracing between jacks and jacking head shall be provided so that pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe. In general, embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the embankment with jacks, into the space thus provided.
4. The Contractor shall furnish for the Owner's Representative's review, a plan showing his proposed method of handling, including the design for the jacking head, jacking support of back stop, arrangement and position of jacks, pipe guides, etc., complete in assembled position. The review of this plan by the Owner's Representative's will not relieve the Contractor from his responsibility to obtain the specified results.
5. The excavation for the underside of the pipe, for at least one third of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of not more than two inches (2") may be provided for the upper half of the pipe. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the pipe. The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but it shall not exceed two feet (2') in any case. This distance shall be decreased on instructions from the Engineer, if the character of the material being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.
6. The pipe, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established will be permitted at the discretion of the Owner's Representative provided that such variation shall be regular, only in one direction and that the final grade of flow line shall be in the direction indicated on the plans.
7. If the Contractor desires, he may use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with inside angles or lugs to keep the cutting edge from slipping back onto pipe.
8. When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
9. Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at no additional cost to the Owner.
10. The pits or trenches excavated to facilitate jacking operations shall be backfilled in accordance with the details for backfilling sewer lines shown in the Drawings immediately after the jacking of the pipe has been completed.

D. Boring

1. The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation of shoring shall be as outlined above under 3.5.C. The location of the pit shall meet the approval of the Owner's Representative. The holes are to be bored mechanically. The boring shall be done using a pilot hole. By this method approximately a two inch (2") pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit.

2. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Jetting will not be permitted.
3. In unconsolidated soil formations a gel forming colloidal drilling fluid consisting of at least 10% of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter.
4. Allowable variation from line and grade shall be as specified under 3.5.C. above. Over cutting in excess of one inch (1") shall be remedied by pressure grouting the entire length of the installation.

3.08 MANHOLES

- A. Manholes shall be constructed at locations shown on the plans and to the depth indicated thereon.
- B. Manholes shall be constructed to the dimensions shown on the plans. Where concrete or precast concrete sections are used, the interior wall shall be coated with 80 mils thickness Raven 405.
- C. Joints between precast concrete sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.
- D. The construction of manholes shall be done as soon as practical after sewer lines into or through the manhole are completed.
- E. All sewers shall be cut neatly at the inside face of the walls of the manhole and pointed up with mortar.
- F. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.
- G. The inverts of the sewer line or several sewer lines entering the manhole at or near the flow line elevation of the manhole shall be shaped and routed across the floor of the manhole using mortar to obtain the proper contour.
- H. When sanitary sewer pipes enter a manhole two (2) feet or greater above the bottom of the manhole, a drop pipe of equal diameter shall be constructed outside the manhole to the bottom of the manhole per the details on the plans.
- I. All Manholes are to be backfilled per the details shown in the Drawings and the requirements of Section 31 23 33 – Trenching, Backfill and Compaction.

3.09 FRAMES, GRATES, RINGS AND COVERS

- A. Casting shall conform to the type shown on the Drawings and shall be clean castings, free from sand or blow holes or other defects. Materials shall be not less than Class 30B gray iron conforming to ASTM A-48.
- B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.
- C. Bearing surfaces between manhole rings and covers and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

3.10 INSPECTION AND TESTING OF GRAVITY SANITARY SEWERS

- A. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- B. Do not put into service before inspection and approval.
- C. Test completed piping systems according to requirements of this section and authorities having jurisdiction.
- D. Schedule tests and inspections by the Owner's Representative and authorities having jurisdiction with at least 48 hours' advance notice.
- E. Submit separate report for each test.
- F. Sanitary Sewer Cleaning and Television Inspection
 - 1. Cleaning:
 - a. Take precautions to protect sanitary sewer mains and manholes from damage that might be inflicted by the improper selection of cleaning processes or improper use of equipment. When using hydraulically-propelled devices take precautions to ensure that the water pressure created does not cause damage to or flooding of public or private property. Do not surcharge any sanitary sewer to an elevation that could cause overflow of sewage into area waterways, homes or buildings, or onto the surface.
 - b. Exercise care to prevent contamination of the potable water system. Use an appropriately sized backflow preventer as required by the authority having jurisdiction when drawing water from a public hydrant.
 - c. Debris Disposal: Remove sludge, soil, sand, rocks, grease, roots and other solid or semi-solid material resulting from the cleaning operation at the downstream manhole of the section being cleaned. Passing debris from any sewer section to any other sewer section is not allowed. Load debris from the manholes into an enclosed container permitted for liquid waste hauling. Remove solids and semi-solids resulting from cleaning operations from the site and dispose of lawfully at the end of each work day. Do not accumulate debris, liquid waste, or sludge on the site.
 - 2. Television Inspection
 - a. Immediately after cleaning, video inspect the sanitary sewer line to document the condition of the line. Notify the Owner's Representative 48

hours in advance of any television inspection so that they may observe inspection operations.

- b. Perform television inspection on one manhole section at a time. Adequately control the flow in the section being inspected. No flow is allowed in the line while performing post-installation video inspection.
- c. Perform television inspection of sanitary sewers as follows:
- d. Videos shall pan all manholes showing benches, walls, annular spaces, and debris removal. Camera operator shall slowly pan each service connection, clamped joint and pipe material transition from one material to another. Complete and submit a Television Inspection Report for every sewer segment video submitted to the Owner's Representative.
- e. Provide a video showing the completed work including the condition of any service connections. Prepare and submit Television Inspection Report forms providing the location of service connections along with the location of any discrepancies.
- f. Document results of video inspections using a Television Inspection Report form approved by the Owner's Representative.

G. Sanitary Sewer Deflection Testing

1. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
2. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing.
3. Pull approved mandrel by hand through sewer sections. Mandrel testing is not required for stubs.
4. Document results of deflection testing using a Sanitary Sewer Deflection Test Report form approved by the Owner's Representative.

H. Sanitary Sewer Leakage Testing

1. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed below.
 - a. Low Pressure Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
 - b. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.

- c. Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria.

	$T = 0.0850(D)(K)/(Q)$
T =	time for pressure to drop 1.0 pounds per square inch gauge in seconds
K =	0.000419 DL, but not less than 1.0
D =	average inside diameter in inches
L =	length of line of same pipe size in feet
Q =	rate of loss, 0.0015 ft ³ /min./sq. ft. internal surface

- d. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given below.
- e. For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.
- f. Document results of low pressure air test using a Sanitary Sewer Low Pressure Air Test Report form approved by the Owner's Representative.

Notes:

- When two sizes of pipe are involved, compute time by ratio of lengths involved.
- Lines with 27-inch average inside diameter and larger may be air tested at each joint.
- Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
- If joint test is used, perform visual inspection of joint immediately after testing.

I. Sanitary Manhole Vacuum Testing

1. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
2. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.
3. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
4. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified below.
5. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury (Hg).
6. Document results of vacuum testing using a Sanitary Sewer Manhole Vacuum Test Report form approved by the Owner's Representative.

3.11 INSPECTION AND TESTING OF SANITARY SEWER FORCE MAINS

A. Hydrostatic Testing

1. After the pipe has been laid and initial backfill completed, the water line shall be subjected to a hydrostatic test per AWWA C600 or AWWA C605 at a minimum pressure of 150 psi. Joints shall remain exposed during testing whenever possible.
2. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test. The meters used in the testing shall be tested, sealed and approved at the Contractor's expense prior to running any test.
3. Where practicable, pipelines shall be tested in lengths between valves or plugs of no more than 1,500 feet. Contractor must have written approval for test sections greater than 1,500 feet.
4. Minimum duration of testing for each section shall be 2 hours when joints are exposed and 8 hours when joints are covered.
5. Allowable leakage shall be as calculated by the following formula:
$$L = (S)(D)(P.05) / 133,200$$

L= Allowable leakage in gallons per hour
S=Length of Pipe in Feet
D=Inside diameter of pipe in inches
P=Pressure in pounds per square inch
6. Correct defects, cracks, or leakage by replacement of defective items. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered shall be replaced, regardless of total leakage shown.
7. Repeat test until satisfactory results are obtained.
8. Upon satisfactory completion of testing, plug openings in force main. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

B. Pigging Test

1. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.
2. Pigs: Provide proving pigs manufactured of open-cell polyurethane foam body, without coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of nominal cross-sectional area of pipe. Pigs shall be able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to force main being tested.

END OF SECTION 33 30 00

SECTION 33 40 00 – STORM DRAINAGE

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. This Section specifies the requirements for furnishing and placing drainage pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.02 DEFINITIONS

- A. CMP: Corrugated metal pipe.
- B. HDPE: High-density polyethylene plastic.
- C. PVC: Polyvinyl chloride plastic.
- D. RCB: Reinforced concrete box.
- E. RCP: Reinforced concrete pipe.

1.03 REGULATORY REQUIREMENTS

- A. Contractor shall comply with standards of authorities having jurisdiction for drainage piping, including materials, installation and testing.
- B. Contractor shall comply with all Standard Specifications and Details of Authorities having Jurisdiction (herein after referred to as "Standard Specifications") for work in the right-of-way or easements.
- C. Prior to commencement of work, the Contractor shall be responsible for obtaining, at the Contractor's own expense, all construction permits necessary to complete the project according to the plans and specifications.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Contractor is responsible for protecting materials per manufactures recommendations

1. Do not store plastic manholes, pipe, and fittings in direct sunlight.
 2. Protect pipe, pipe fittings, and seals from dirt and damage.
 3. Handle precast structures according to manufacturer's written rigging instructions.
- C. Install drainage system that is watertight both in pipe-to-pipe joints and in pipe to-manhole connections.

PART 2 – PRODUCTS

2.01 CMP PIPE

- A. Corrugated metal pipe shall be galvanized steel conforming to the requirements of AASHTO M 218
1. Reference to gauge of metal is to U.S. Standard Gauge for uncoated sheets. Tables in AASHTO M 218 list thicknesses for coated sheets in inches.
- B. Coupling bands and other hardware for galvanized steel pipe shall conform to requirements of AASHTO M 36.
1. Coupling bands shall be not more than 3 nominal sheet thicknesses lighter than thickness of pipe to be connected and in no case lighter than 0.052 inch.
 2. Coupling bands shall be made of same base metal and coating (metallic or otherwise) as pipe.
 3. Minimum width of corrugated locking bands shall be as shown below for corrugations which correspond to end circumferential corrugations on pipes being joined:
 - a. 10-1/2 inches wide for 2-2/3 inch by 1/2 inch corrugations.
 - b. 12 inches wide for 3 inch by 1 inch corrugations.
 4. Helical pipe without circumferential end corrugations will be permitted only when it is necessary to join new pipe to existing pipe which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at ends shall be field jointed with either helically corrugated bands or with bands with projections (dimples). Minimum width of helical corrugated bands shall conform to following:
 - a. 12 inches wide for 1/2 inch deep helical end corrugations.
 - b. 14 inches wide for 1 inch deep helical end corrugations.
 5. Bands with projections shall have circumferential rows of projections with one projection for each corrugation. Width of bands with projections shall be not less than following:
 - a. 12 inches wide for pipe diameters up to and including 72 inches. Bands shall have two circumferential rows of projections.
 - b. 16-1/4 inches wide for pipe diameters of 78 inches and greater. Bands shall have four circumferential rows of projections.
 6. Bolts for coupling bands shall be 1/2 inch diameter. Bands 12 inches wide or less will have minimum of 2 bolts per end at each connection, and bands greater than 12 inches wide shall have minimum of 3 bolts at each connection.
 7. Galvanized bolts may be hot dip galvanized in accordance with requirements of AASHTO M 232, mechanically galvanized to provide same requirements as AASHTO M 232, or electro galvanized per ASTM B 633, Type RS.
- C. Furnish fittings and specials required for bends, end sections, branches, access manholes, and connections to other fittings. Design fittings and specials in

accordance with Drawings and ASTM A 760. Fittings and specials are subject to same internal and external loads as straight pipe.

D. Fabrication

1. Steel Pipe:

- a. Galvanized steel pipe shall be full circle or arch pipe conforming to AASHTO M 36, Type I, Type IA, or Type II, as indicated on Drawings.
- b. Fabrication with circumferential corrugations, lap joint construction with riveted or spotwelded seams, helical corrugations with continuous helical lock seam, or ultra-high frequency resistance butt-welded seams is acceptable.

2.02 HDPE PIPE

- A. Furnish annular corrugated profile wall polyethylene pipe conforming to ASTM F2648 for gravity storm sewer and storm sewer culvert pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line.
- B. Joints
 1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged.
 2. Shall be watertight according to the requirements of ASTM D3212.
- C. Gaskets shall meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.
- D. Fittings shall conform to ASTM F2306.
- E. Perforated pipe shall conform to the requirements of ASTM M252 for pipe diameters 3-inch through 10-inch and ASTM M294 for pipe diameters 12-inch through 60-inch.

2.03 PVC PIPE

- A. PVC pipe shall conform to ASTM D3034, SDR 26. All diameters shall use bell and spigot ends for gasketed joints.
- B. Joints shall conform to ASTM D3212 with a SDR matching the pipe.
- C. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
- D. Fittings shall conform to ASTM D3034.
- E. Do not use PVC in potentially or known contaminated areas.
- F. Do not use PVC in areas exposed to direct sunlight.

- G. Make curves and bends by bending the pipe, do not exceed maximum limits of curvature recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by the Owner's Representative.

2.04 RCP PIPE

- A. Reinforced concrete pipe shall conform to requirements of ASTM C-76, wall "B" thickness for, Class III and Class IV as shown on the plans or as necessary to meet ASTM cover design requirements.
- B. Reinforced concrete arch pipe shall conform to requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.
- C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Use rubber gasket joints conforming to ASTM C 877.
- D. Gaskets shall conform to AWWA C111, rubber.
- E. Gaskets
 - 1. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.
 - 2. Use gaskets as recommended by pipe manufacturer and approved by the Owner's Representative prior to installation in potentially contaminated soil.

2.05 RCB PIPE

- A. Reinforced concrete boxes shall conform to requirements of ASTM C1577.

2.06 MANHOLES

- A. Precast concrete manholes in accordance with the details shown on the Drawings shall conform to ASTM C-478.
- B. Cast-in-Place-Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated. The minimum compressive strength of concrete manhole shall be 4,000 psi.
- C. Ballast: Increase thickness of concrete as required to prevent flotation.
- D. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
- E. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

2.07 PRECAST CONCRETE INLETS, HEADWALLS AND WINGWALLS

- A. Provide precast concrete machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength of concrete shall be 4,000 psi.
- B. Reinforcing Steel shall conform to requirements of ASTM A615, Grade 60.
- C. Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

2.08 PVC INLETS

- A. PVC surface drainage inlets shall include the drain basin type as indicated on the drawings. The ductile iron grates for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer.
- B. PVC inlets shall be manufactured from PVC pipe stock, utilizing a thermoforming process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The flexible elastomeric seals shall conform to ASTM F477. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The raw material used to manufacture the pipe stock that is used to manufacture the main body and pipe stubs of the surface drainage inlets shall conform to ASTM D1784 cell class 12454.
- C. The grates and frames furnished for all PVC inlets shall be ductile iron and shall be made specifically for each basin so as to provide a round bottom flange that closely matches the diameter of the inlet. Grates for drain basins shall be capable of supporting H-20 wheel loads. Ductile iron used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05. Grates and covers shall be provided painted black.

2.09 MORTAR

- A. Mortar shall conform to ASTM C 476.

2.10 CLEANOUTS

- A. Cleanouts in accordance with the details shown on the Drawings shall consist of PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.11 RIMS, GRATES AND FRAMES

- A. Castings for manhole and inlet rims, covers, grates and frames shall conform to ASTM A 48, Class 35B gray iron or better quality.

2.12 MANUFACTURERS

- A. Use approved American manufacturers.

PART 3 – EXECUTION

3.01 PREPERATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage and displacement.
- B. Verify all existing utilities prior to beginning construction. Inform the Owner's Representative if existing utilities are not as shown in the plans.
- C. Perform work in accordance with OSHA standards.
- D. Drainage to the site and adjacent landowners shall not be obstructed without prior approval of the Owner's Representative and the authority having jurisdiction. At no additional cost to the Owner the Contractor shall install necessary piping and accessories so as not to disrupt drainage from other facilities or landowners whether or not indicated on the plans.
- E. Before installation, inspect each pipe, fitting and structure for defects. Reject defective, damaged or unsound pipe, fittings or structures and remove them from site.

3.02 GENERAL

- A. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of the trench has been properly shaped.
- B. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.
- C. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream. Establish required uniform line and grade in trench from benchmarks identified by the Owner's Representative. Use laser beam equipment to establish and maintain proper line and grade of work.
- D. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.
- E. A minimum clearance of twelve (12) inches must be maintained between the drainage system and all other lines.
- F. Outfall pipes shall be as detailed on the drawings and conform to the requirements of the authority having jurisdiction.
- G. Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps and suitable means such as well points or pervious underdrain

bedding until the pipe has been installed and the backfill has been placed to a sufficient height to prevent pipe flotation. Care should be taken that any underdrain is of proper gradation and thickness to prevent migration of material between the underdrain, pipe embedment and native soils in the trench below and at the sides of the pipe.

- H. Do not allow sand, debris, runoff or other foreign materials to enter sewer system.

3.03 EARTHWORK

- A. Conform to applicable provisions of Section 31 23 33 Trenching, Backfilling and Compaction.
- B. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- C. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.
- D. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.04 PIPE CUTTING

- A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by the Owner's Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.05 PIPE INSTALLATION BY OPEN CUT

- A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.
- B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed.
- C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.
- D. Form concentric joint with each section of adjoining pipe so as to prevent offsets.
- E. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.
- F. Provide lubricant, place and drive home newly laid sections so as to eliminate damage to sections. Install pipe to "home" mark where provided.
- G. Keep excavations free of water during construction and until final inspection.

- H. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

3.06 PIPE INSTALLATION OTHER THAN OPEN CUT

- A. Contractor shall utilize methods of pipe installation other than open cut as shown on the Drawings or as otherwise required to install the sewer.
- B. Pipe shall be of the size, type, and class specified on the Plans, or other types as may be specified by the Engineer or designated on the Plans.
- C. Jacking
 - 1. If the grade of the pipe at the jacking end is below the ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner satisfactory to the Owner's Representative to prevent earth caving.
 - 2. Where pipe is required to be installed under railroad embankments or under highways, streets, or other facilities by jacking or boring methods, construction shall be made in such a manner that will not interfere with the operation of the railroad, street, highway, or other facility, and shall not weaken or damage any embankment or structure. During construction operations, barricades and lights to safeguard traffic and pedestrians shall be furnished and maintained, as directed by the Owner's Representative, until such time as the backfill has been completed and then shall be removed from the site.
 - 3. Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating jacks, even pressure shall be applied to all jacks used. A suitable jacking head, usually of timber, and suitable bracing between jacks and jacking head shall be provided so that pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides, properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The whole jacking assembly shall be placed so as to line up with the direction and grade of the pipe. In general, embankment material shall be excavated just ahead of the pipe and material removed through the pipe, and the pipe forced through the embankment with jacks, into the space thus provided.
 - 4. The Contractor shall furnish for the Owner's Representative's review, a plan showing his proposed method of handling, including the design for the jacking head, jacking support of back stop, arrangement and position of jacks, pipe guides, etc., complete in assembled position. The review of this plan by the Owner's Representative's will not relieve the Contractor from his responsibility to obtain the specified results.
 - 5. The excavation for the underside of the pipe, for at least one third of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of not more than two inches (2") may be provided for the upper half of the pipe. This clearance is to be tapered off to zero at the point where the excavation conforms to the contour of the pipe. The distance that the excavation shall extend beyond the end of the pipe depends on the character of the material, but it shall not exceed two feet (2') in any case. This distance shall be decreased on instructions from the Engineer, if the character of the material

being excavated makes it desirable to keep the advance excavation closer to the end of the pipe.

6. The pipe, preferably, shall be jacked from the low or downstream end. Lateral or vertical variation in the final position of the pipe from the line and grade established will be permitted at the discretion of the Owner's Representative provided that such variation shall be regular, only in one direction and that the final grade of flow line shall be in the direction indicated on the plans.
7. If the Contractor desires, he may use a cutting edge of steel plate around the head end of the pipe extending a short distance beyond the end of the pipe with inside angles or lugs to keep the cutting edge from slipping back onto pipe.
8. When jacking of pipe is once begun, the operation shall be carried on without interruption, insofar as practicable, to prevent the pipe from becoming firmly set in the embankment.
9. Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at no additional cost to the Owner.
10. The pits or trenches excavated to facilitate jacking operations shall be backfilled in accordance with the details for backfilling sewer lines shown in the Drawings immediately after the jacking of the pipe has been completed.

D. Boring

1. The boring shall proceed from a pit provided for the boring equipment and workmen. Excavation for pits and installation of shoring shall be as outlined above under 3.5.C. The location of the pit shall meet the approval of the Owner's Representative. The holes are to be bored mechanically. The boring shall be done using a pilot hole. By this method approximately a two inch (2") pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit.
2. This pilot hole shall serve as the centerline of the larger diameter hole to be bored. Excavated material will be placed near the top of the working pit and disposed of as required. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Jetting will not be permitted.
3. In unconsolidated soil formations a gel forming colloidal drilling fluid consisting of at least 10% of high grade carefully processed bentonite may be used to consolidate cuttings of the bit, seal the walls of the hole, and furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter.
4. Allowable variation from line and grade shall be as specified under 3.5.C. above. Over cutting in excess of one inch (1") shall be remedied by pressure grouting the entire length of the installation.

3.07 MANHOLES, INLETS, JUNCTION BOXES AND OTHER STRUCTURES

- A. Structures shall be constructed in accordance with the details shown on plans at locations shown on the plans and to the depth indicated thereon.
- B. Joints between precast concrete sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.
- C. The construction of structures shall be done as soon as practical after sewer lines into or through the manhole are completed.

- D. All sewers shall be cut neatly at the inside face of the walls of the manhole and pointed up with mortar.
- E. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.
- F. All Manholes are to be backfilled per the details shown in the Drawings and the requirements of Section 31 23 33 – Trenching, Backfill and Compaction.

3.08 FRAMES, GRATES, RINGS AND COVERS

- A. Casting shall conform to the type shown on the Drawings and shall be clean castings, free from sand or blow holes or other defects. Materials shall be not less than Class 30B gray iron conforming to ASTM A-48.
- B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.
- C. Bearing surfaces between manhole rings and covers and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

3.09 UNDERDRAIN SYSTEM

- A. Pipe shall be laid per paragraph 3.1 and per the details on the plans.
- B. Prior to placing granular backfill and bedding, line trench with drainage fabric according to the details.
- C. Granular bedding shall be prepared to a depth of 2 to 4 inches below the pipe invert. The pipe shall be laid with the perforations facing down. The granular backfill shall then be placed to the depth shown on the details. The filter fabric shall then be wrapped around the granular material with a minimum overlap at the top of 6 inches.
- D. Where vertical pipe risers penetrate the granular backfill to the surface, the drainage fabric shall be cut in an 'X' to accommodate the pipe penetration and then the fabric shall be sealed with a heavy duty tape to the pipe in the manner to insure the integrity of the filter fabric.

3.10 CLEANING AND INSPECTION

- A. Clean and inspect new piping systems, and parts of existing systems that have been altered, extended, repaired, or otherwise impacted by the construction.
- B. Schedule cleaning and inspections by the Owner's Representative and authorities having jurisdiction with at least 48 hours' advance notice.
- C. Cleaning:
 - 1. Take precautions to protect storm sewer mains and structures from damage that might be inflicted by the improper selection of cleaning processes or improper use of equipment. When using hydraulically-propelled devices take

- precautions to ensure that the water pressure created does not cause damage to or flooding of public or private property.
2. Exercise care to prevent contamination of the potable water system. Use an appropriately sized backflow preventer as required by the authority having jurisdiction when drawing water from a public hydrant.
 3. Debris Disposal: Remove soil, sand, rocks, construction debris and other solid or semi-solid material resulting from the cleaning operation at the downstream structure of the section being cleaned. Passing debris from any section to any other section is not allowed. Load debris from the structures into an enclosed container permitted for waste hauling. Remove solids and semi-solids resulting from cleaning operations from the site and dispose of lawfully at the end of each work day. Do not accumulate debris or liquid waste on the site.
- D. Inspect all structures and interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
- E. Repair or replace defective piping or structures as required by the Owner's Representative and repeat inspections until results are satisfactory.

END OF SECTION 33 40 00

THIS PAGE INTENTIONALLY LEFT BLANK