DLRGROUP

ARCHITECTURE ENGINEERING PLANNING INTERIORS

Connally High School Renovation

13212 N Lamar Boulevard
Austin, Texas 78753

Project Manual

BID & PERMIT

DLR Group Project No. 39-25124-00

28 FEBRUARY 2025

NOTICE: These documents are instruments of professional service, and information contained therein is incomplete unless used in conjunction with DLR Group's interpretations, decisions, observations and administrations. Use or reproduction of these documents in whole or in part without DLR Group's consent is in violation of common law, copyrights, statutory and other reserved rights, which preempts state and local public records act. Portions of these specifications were created with the MasterSpec® specification writing system, are subject to the copyright of the American Institute of Architects, and require a current MasterSpec® license for editing or use on other projects.

Copyright DLR Group

Project Manual

Connally High School Renovation

13212 N Lamar Boulevard

Austin, Texas 78753

BID & PERMIT
Specification Manual

DLR Group Project No. 39-25124-00

28 FEBRUARY 2025

DLR Group inc. of Texas, a Texas corporation
Architecture Engineering Planning Interiors
816 Congress Avenue, Suite 1600
Austin, Texas 78701
tel 512-898-9090

SECTION 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

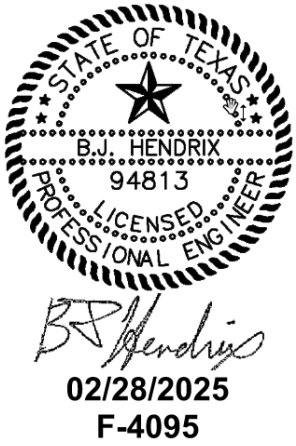
A. Architect:

1. Jonathan Loiselle, AIA
2. Texas License No. 25043.
   Responsible for Divisions 01-12 Sections except where indicated as prepared by other design professionals of record.



B. Fire-Protection, Plumbing, Mechanical and Electrical Engineer:

1. Byron J. Hendrix
2. Texas License No. 94813.
3. Responsible for Divisions 20, 21, 22, 23, 26 and 28.



END OF SECTION 000107

SECTION 000110 – TABLE OF CONTENTS

DIVISION 00 — PROCUREMENT AND CONTRACTING REQUIREMENTS

000107 SEALS PAGE
000110 TABLE OF CONTENTS
002600 PROCUREMENT SUBSTITUTION PROCEDURES
002600A SUBSTITUTION REQUEST FORM
003126 EXISTING HAZARDOUS MATERIAL INFORMATION

DIVISION 01 — GENERAL REQUIREMENTS

012500 SUBSTITUTION PROCEDURES
014000 QUALITY REQUIREMENTS
014200 REFERENCES
016000 PRODUCT REQUIREMENTS
017300 EXECUTION
017700 CLOSEOUT PROCEDURES
017823 OPERATION AND MAINTENANCE DATA
017839 PROJECT RECORD DOCUMENTS

DIVISION 02 — EXISTING CONDITIONS

024119 SELECTIVE DEMOLITION

DIVISION 04 — MASONRY

042000 UNIT MASONRY

DIVISION 05 — METALS

053100 STEEL DECKING
055000 METAL FABRICATIONS

DIVISION 06 — WOOD, PLASTICS, AND COMPOSITES

061000 ROUGH CARPENTRY

DIVISION 07 — THERMAL AND MOISTURE PROTECTION

076200 SHEET METAL FLASHING AND TRIM

DIVISION 08 — OPENINGS

084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
084523 4INCH INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT SYSTEM
084524 4INCH INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL SYSTEM
087100 FACILITY GUIDELINES FINISH HARDWARE
088000 GLAZING

DIVISION 09 — FINISHES

092216 NON-STRUCTURAL METAL FRAMING
092900 GYPSUM BOARD
093013 CERAMIC TILING
095123 ACOUSTICAL TILE CEILINGS
095423 LINEAR METAL CEILINGS
099123 INTERIOR PAINTING

DIVISION 10 — SPECIALTIES

102116.01 HDPE TOILET COMPARTMENTS
102800 TOILET, BATH, AND LAUNDRY ACCESSORIES

DIVISION 12 — FURNISHINGS

122413 ROLLER WINDOW SHADES
126600 GYMNASIUM BLEACHERS
126613 TELESCOPIC SEATING

DIVISION 20 — MECHANICAL SUPPORT

200000 GENERAL PROVISIONS
200100 BASIC MATERIALS & METHODS
200200 SCHEDULES OF VALUES
200700 INSULATION

DIVISION 21 — FIRE SUPPRESSION

210000 FIRE PROTECTION

DIVISION 22 — PLUMBING

220100 INSIDE UTILITY TRENCH EXCAVATION, BACKFILL AND COMPACTION
221116 WATER DISTRIBUTION SYSTEM
221316 LIQUID WASTE TRANSFER
223000 PLUMBING FIXTURES AND TRIM

DIVISION 23 — HEATING VENTILATING AND AIR CONDITIONING

230593 TEST AND BALANCE
233000 AIR DISTRIBUTION

DIVISION 26 — ELECTRICAL

260500 GENERAL
260510 SCHEDULE OF VALUES
260519 WIRE & CABLE
260526 GROUNDING & BONDING
260529 HANGER & SUPPORTING DEVICES
260533 RACEWAYS
260534 OUTLET BOXES, PULL BOXES, & JUNCTION BOXES
260580 EMPTY RACEWAY ROUGH-IN
261500 ELECTRICAL DEMOLITION REMODELING

262726 DEVICES
262815 SAFETY DISCONNECT SWITCH
262816 FUSES
262825 CONTACTORS
26500 INTERIOR LIGHTING SYSTEM
265600 EXTERIOR LIGHTING SYSTEM
269995 COMMISSIONING OF ELECTRICAL SYSTEMS

DIVISION 28 — ELECTRONIC SAFETY AND SECURITY

284600 FIRE ALARM & DETECTION SYSTEM

END OF SECTION 000110

SECTION 002600 - PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids in accordance with Instructions to Bidders.

B. Procurement Prior Approval Requests: Requests for approval of products or manufacturers from those required by the Contract Documents as defined by product selection procedures in Section 016000 "Product Requirements."

1. Procurement prior approval is required when products or manufacturers are listed in specifications under "Sole Product," "Sole Manufacturer," "Limited List of Products," or "Limited List of Manufacturers" introductory paragraphs.
2. Procurement prior approval is not required when products or manufacturers are listed in specifications under "Non-Limited List of Products" or "Non-Limited List of Manufacturers" introductory paragraphs.
3. Where use of "Sole Product," "Sole Manufacturer," "Limited List of Products," or "Limited List of Manufacturers" introductory paragraphs is not allowed by statute, procurement prior approval request is not required.

C. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See the General Conditions and Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

1. Extensive revisions to the Contract Documents are not required.

2. Proposed changes are in keeping with general intent of the Contract Documents, including level of quality of the Work represented by requirements therein.
3. Request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:

1. Requests for substitution of materials and equipment will be considered if received no later than TEN (10) days prior to date of bid opening.
2. Submittal Format, Electronic: Submit Procurement Substitution Request, using format provided on Project web-based bidding management software site.

a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and Drawing numbers.
b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

1) List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
2) Product data, including drawings and descriptions of products and fabrication and installation procedures.
3) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
4) Copies of current, independent third-party test data of salient product or system characteristics.
5) Samples where applicable or when requested by Architect.
6) Detailed comparison of significant qualities of proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
7) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
8) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
9) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate proposed substitute.

c. Provide certification by manufacturer that proposed substitute is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to product or equipment specified in the application indicated.

d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all Bidders of acceptance of proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of substitute during bidding does not relieve Contractor of the responsibility to submit required Shop Drawings and to comply with all other requirements of the Contract Documents.

END OF SECTION 002600

PROCUREMENT SUBSTITUTION REQUEST FORM

To: DLR Group inc. of Texas, a Texas corporation
816 Congress Avenue, Suite 1600
Austin, Texas 78701
TEL: 512-898-9090

PROJECT: _____

We hereby submit for your consideration the following product as substitute for specified item for the above project:

Section	Page	Paragraph/Line	Specified Item

Proposed Substitution:_____

Attach complete product description, drawings, photographs, performance and test data, warranty, information and other information necessary for evaluation. Identify specific model numbers, finishes, options, etc.

A. Will changes be required to building design or drawing dimensions in order to properly install proposed substitution? Yes__ No__. If yes, explain.

_____

B. Will the undersigned pay for changes to the building design, including engineering and drawings costs, caused by requested substitution? Yes__ No__.

C. Differences between proposed substitution and specified item.

_____

_____

D. What affect does substitution have on other trades? ____

_____

E. Does manufacturer's warranty of the proposed substitution differ from that specified? Yes__ No_____.

If yes, explain _

_____

Submitted by:

_____ For Architect's Use Only:
Signature

_____ __Accepted __Accepted as Noted
Firm

_____ ___Not Accepted ___Received Too Late
Address

_____ By:_____
Date:_____
Remarks:_____

Date: _____

_____

Telephone:____

SECTION 003126 - EXISTING HAZARDOUS MATERIAL INFORMATION

1.1 EXISTING HAZARDOUS MATERIAL INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for the Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. An existing asbestos report for Project, prepared by Pflugerville Independent School District (TX) dated February 26, 2025, is available for viewing as appended to this Project Manual.

C. Related Requirements:

1. Section 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.
2. Section 024119 "Selective Demolition" for notification requirements if materials suspected of containing hazardous materials are encountered.

END OF SECTION 003126

SECTION 012500 - SUBSTITUTION PROCEDURES

1.1 ACTION SUBMITTALS

A. Documentation:

1. Justification.
2. Coordination information.
3. Detailed comparison.
4. Product Data.
5. Samples.
6. Certificates and qualification data.
7. List of similar installations.
8. Material test reports.
9. Research reports.
10. Detailed comparison of Contractor's construction schedule.
11. Cost information.
12. Contractor's certification.
13. Contractor's waiver of rights to additional payment or time.

B. Architect's Action: If necessary, Architect will request additional information within seven (7) days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection within fifteen (15) days of receipt, or seven (7) days of receipt of additional information.

1.2 SUBSTITUTIONS

A. Substitutions for Cause: Not later than fifteen (15) days prior to time required for preparation and review of submittals.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

C. Substitutions for Convenience: Will be considered if received within sixty (60) days after the Notice of Award.

END OF SECTION 012500

SECTION 014000 - QUALITY REQUIREMENTS

1.1 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements.

C. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction.

1.2 QUALITY ASSURANCE

A. Delegated Design Services: For products and systems assigned to Contractor to be designed and certified by Contractor's design professional to be in compliance with performance and design criteria.

B. Qualifications:

1. Contractor's quality-control personnel.
2. Manufacturer.
3. Fabricator.
4. Installer.
5. Professional engineer performing delegated design services.
6. Specialists.
7. Testing agency.
8. Manufacturer's technical representative.
9. Factory-authorized service representative.

C. Preconstruction testing.

D. Mockups: Not required

1.3 QUALITY CONTROL

A. Owner Responsibilities: Where indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Payment will be made from testing and inspecting allowances.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility.

C. Manufacturer's field services.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Associated Services: Access to the Work, taking and storing samples, and delivery of samples to testing agency.

F. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

G. Test and inspection log.

H. Repair and Protection: Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

1.1 DEFINITIONS

A. Approved.

B. Directed.

C. Indicated.

D. Regulations.

E. Furnish.

F. Install.

G. Provide.

H. Project site.

1.2 INDUSTRY STANDARDS

A. Publication Dates: In effect as of the date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Contractor referred to Gale's "Encyclopedia of Associations: National Organizations of the U.S." or Columbia Books' "National Trade & Professional Associations of the United States

B. Code Agencies: List included in this Section.

C. Federal Government Agencies: List included in this Section.

D. Standards and Regulations: List included in this Section.

E. State Government Agencies: List included in this Section.

END OF SECTION 014200

SECTION 016000 - PRODUCT REQUIREMENTS

1.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Use means and methods that will prevent damage, deterioration, and loss, including theft.

B. Store products to allow for inspection and measurement or counting of units.

C. Provide for storage of materials and equipment by Owner.

1.2 PRODUCT WARRANTIES

A. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1.3 PRODUCT SELECTION PROCEDURES

A. Sole Product: Product named that complies with requirements.

B. Sole Manufacturer/Source: Product by manufacturer or from source named that complies with requirements.

C. Limited List of Products: One of the products listed that complies with requirements. Comparable products will be considered.

D. Limited List of Manufacturers: Product by one of the manufacturers listed that complies with requirements. Comparable products will be considered.

E. Non-Limited List of Products: One of the products listed that complies with requirements, or another product submitted by Contractor that meets requirements. Substitution request is not required.

F. Non-Limited List of Manufacturers: Product by one of the manufacturers listed that complies with requirements, or product of another manufacturer that meets requirements. Substitution request is not required.

G. Basis-of-Design Product: Either the specified product or a comparable product by one of the other named manufacturers, approved by Architect prior to normal Project submittal.

H. Visual Matching Specification: Product that matches Architect's sample. Architect's decision will be final.

I. Visual Selection Specification: Product (and manufacturer) that complies with other specified requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

J. Sustainable Product Selection: Where specified, select product meeting sustainable product characteristics and for which sustainable design documentation submittals are available from manufacturer.

1.4 COMPARABLE PRODUCTS

A. Conditions for Consideration:

1. Product does not require revisions to the Contract Documents, is consistent with the Contract Documents and will produce the indicated results, and is compatible with other portions of the Work.
2. Comparison of proposed product with those named in the Specifications.
3. Product provides specified warranty.
4. Similar installations, if requested.
5. Samples, if requested.

END OF SECTION 016000

SECTION 017300 - EXECUTION

1.1 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.2 INFORMATIONAL SUBMITTALS

A. Qualification data.

B. Certificates: Signed by land survey or certifying that location and elevation of improvements comply with requirements.

C. Cutting and patching plan.

D. Certified Surveys: Signed by land surveyor.

E. Final property survey.

1.3 MATERIALS

A. Complete final cleaning using products that comply with Green Seal's GS-37 and the California Code of Regulations maximum allowable VOC levels.

1.4 EXECUTION

A. Existing Conditions: Existence and location of site improvements, utilities, and other construction affecting the Work must be investigated and verified.

B. Review of the Contract Documents and field conditions.

C. Construction Layout: Engage a land surveyor to lay out the Work, using accepted surveying practices.

D. Field Engineering: Owner will identify existing benchmarks, control points, and property corners. Locate existing permanent benchmarks, control points, and similar reference points.

1. Benchmarks: Establish zero permanent benchmarks on Project site.
2. Certified survey of construction and sitework.
3. Final property survey.

E. Installation: Comply with manufacturer's written instructions.

1.5 CUTTING AND PATCHING

A. Provide temporary support.

B. Protect in-place construction.

C. Protect adjacent occupied areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Minimize interruption to occupied areas.

E. Cutting: In general, use hand or small power tools. Cut holes and slots neatly to minimum size required. Temporarily cover openings when not in use.

F. Patching: Patch with durable seams that are as invisible as practicable.

G. Finishes: Restore exposed finishes. Extend new finishes to perimeter of patched surface. Leave patched work indistinguishable from existing undisturbed work.

1.6 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Coordinate the Work with work performed by Owner's construction personnel and Owner's separate contractors.

B. Provide temporary facilities for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.

C. Provide access to Project site for Owner's personnel.

D. Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable.

E. Include Owner's personnel at preinstallation conferences.

1.7 PROGRESS CLEANING

A. Clean Project site and work areas daily. Dispose of materials lawfully.

B. Keep installed work clean.

C. Remove debris from concealed spaces.

1.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation.

B. Adjust equipment for proper operation.

1.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure Work is without damage.

1.10 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

1.1 CLOSEOUT PROCEDURES

A. Prepare and submit Contractor's list of incomplete items (punch list) in the form of web-based Project management website.

B. Submit closeout items required in other Sections.

C. Submit Project warranties.

D. Complete final cleaning using products that comply with Green Seal's GS-37 and the California Code of Regulations maximum allowable VOC levels.

E. Replace bulbs that are dim or burned out.

F. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1. Clean HVAC system in compliance with NADCA ACR or Section 230130.52 "Existing HVAC Air-Distribution System Cleaning." if provided. Provide written report on completion of cleaning.

G. Touch up or repair finishes and adjacent finishes.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

1.1 SUMMARY

A. Procedures for preparing the following manuals:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

1.2 PRODUCTS

A. Format:

1. PDF electronic files on digital media acceptable to Architect by uploading to web-based project software site.
2. Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, one (1) set(s) of copies.

B. Directory Manuals: Organized reference to emergency, operation, and maintenance manuals.

C. Emergency Manuals: Types of emergencies, emergency instructions, and emergency procedures.

D. Operation Manuals: System, subsystem, and equipment descriptions; operating procedures; wiring diagrams; control diagrams and sequence of operation; and piped system diagrams.

E. Product Maintenance Manuals: Source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds.

F. Systems and Equipment Maintenance Manuals: Source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

1.1 RECORD DOCUMENTS

A. Record Drawings:

1. Initial Submittal: PDF electronic files.
2. Final Submittal: PDF electronic file.

B. Record Specifications: Annotated PDF electronic files.

C. Record Product Data: Annotated PDF electronic files and directories.

D. Miscellaneous Record Submittals: Annotated PDF electronic files and directories.

E. Record Digital Data Files: Corrected digital data files of the Contract Drawings, as follows:

1. Format: Same as the original Contract Drawings.
2. Format: DWG Version 12.0 or later, Microsoft Windows operating system.
3. Format: Annotated PDF electronic file with comment function enabled.

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

1.1 FIELD CONDITIONS

A. Owner will not occupy portions of building adjacent to selective demolition area.

B. Hazardous Materials: Removed by Owner prior to start of the Work

1.2 WARRANTY

A. Existing Warranties: None .

1.3 EXAMINATION

A. Perform an engineering survey of condition of building.

B. Utilize penetrating radar to prior to cutting of wall CMU and floor slab to document rebar and supporting steel locations. Provide report to Architect for review prior to cutting.

C. Coordinate new roof openings with supporting roof structure prior to cutting.

1.4 PREPARATION

A. Refrigerant: Remove in accordance with 40 CFR 82.

1.5 UTILITY SERVICES AND BUILDING SYSTEMS

A. Utility Shutoff: By Contractor.

1.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Dispose of in an EPA-approved landfill.

1.7 SELECTIVE DEMOLITION SCHEDULE

A. Owner responsible for all removal of salvaged items prior to demolition.

END OF SECTION 024119

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Brick.
4. Mortar and grout materials.
5. Reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Accessories.
9. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.
2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.2 ALLOWANCES

A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. Brick, in the form of straps of five or more bricks.
2. Mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Weep/cavity vents.
4. Cavity drainage material.
5. Accessories embedded in masonry.

D. Delegated Design Submittals: For masonry anchors and ties, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M[Retain first subparagraph below only if retaining unit-strength method in "Performance Requirements" Article or if requirements for average net-area compressive strength of units are retained in Part 2.
e. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.

9. Anchors, ties, and metal accessories.

B. Qualification Statements: For testing agency.

C. Delegated design engineer qualifications.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
2. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain exposed masonry units cementitious mortar components and mortar aggregate from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602.
2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Rigid, Cellular Thermal Insulation Units: Where indicated, units contain rigid, specially shaped, molded-polystyrene insulation units complying with ASTM C578, Type I, designed for installing in cores of masonry units.

C. CMUs: ASTM C90, normal weight

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi 2800 psi
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.5 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.

B. Clay Face Brick: Facing brick complying with ASTM C216.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
4. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 ft.
5. Size (Actual Dimensions): Match existing.
6. Application: Use where brick is exposed unless otherwise indicated.
7. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork.
8. Color and Texture: match existing.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Cement: ASTM C1329/C1329M.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Preblended Dry Mortar Mix: Packaged blend made from mortar cement, sand, mortar pigments, water repellents, and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix
2. Preblended Dry Masonry Cement Mortar Mix

H. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

I. Aggregate for Grout: ASTM C404.

J. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

K. Refractory Mortar Mix: Ground fireclay or nonwater-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C199 test; or an equivalent product acceptable to authorities having jurisdiction.

L. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C , and recommended by manufacturer for use in masonry mortar of composition indicated.

M. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

N. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches wide, plus one side rod at each wythe of masonry 4 inches wide or less.
2. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch cover on outside face.
3. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face

F. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized carbon steel continuous wire.

2.8 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.

3. Stainless Steel Wire: ASTM A580/A580M, Type 3046.
4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
8. Stainless Steel Bars: ASTM A276 or ASTM A666, Type 304.

C. Corrugated-Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from 0.0336-inch-thick steel sheet, galvanized after fabrication.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long for masonry constructed from solid units.
2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
5. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie
6. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie
7. Masonry-Veneer Anchors; Slotted Plate: Sheet metal anchor section, with screw holes at top and bottom; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. Use self-adhering tape to seal penetration behind anchor plate.
8. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.

9. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless steel shank.

2.9 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel , with sawtooth ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
7. Fabricate metal drip edges for sawtooth metal flashing from plain metal flashing of same metal as sawtooth flashing and extending at least 3 inches into wall with hemmed inner edge to receive sawtooth flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
8. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
9. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
10. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
11. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric with a butyl adhesive, to produce an overall thickness of 10 mil.

    a. Applications: Use 10-mil- thick flashing at windows, doors, and small wall penetrations; not at base of walls

C. Drainage Plane Flashing: Fabricate from stainless steel and drainage membrane to shapes indicated, including weep tabs, termination bar, and drip edge. Provide flashing materials as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 60 inches long, minimum.
3. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

E. Solder and Sealants for Sheet Metal Flashings.

F. Grade Sn60 solder is 40 percent lead; Grade Sn96 is 0.10 percent lead; and Grade Sn50 is 50 percent lead.

1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.

G. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

C. Weep/Cavity Vents: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity dovetail-shaped notches that prevent clogging with mortar droppings.

E. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.11 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. For exterior masonry, use or mortar cement mortar.
3. For reinforced masonry, use masonry cement mortar.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products to match existing.

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Pigments do not exceed 5 percent of masonry cement or mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

F. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.

1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in match existing bond pattern ; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Lay structural clay tile as follows:

1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- thick joints.

D. Set firebox brick in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately 1/8 inch. Tool joints smooth on surfaces exposed to fire or smoke.

E. Install clay flue liners to comply with ASTM C1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar 1/16 to 1/8 inch thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.

F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

G. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

H. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each **[2.67 sq. ft.] [3.5 sq. ft.]** of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges and sealant stops with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.

8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.

E. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes 24 inches o.c. unless otherwise indicated.
4. Space weep holes formed from plastic tubing 16 inches o.c.
5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.

F. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.

1. Fill cavities full height by placing pea gravel in cavities as masonry is laid, so that at any point, masonry does not extend more than 24 inches above top of pea gravel.

G. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

H. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

H. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

J. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at 7 days and at 28 days.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic masonry cleaner applied according to manufacturer's written instructions.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 053100 - STEEL DECKING

1.1 QUALITY ASSURANCE

A. Electrical Raceway Units: UL labeled.

B. FM Approvals' RoofNav Listing: Steel roof deck.

1.2 STEEL DECK

A. Cellular Roof Deck: Galvanized- steel sheet.

1. Profile Depth: match existing.

B. Noncomposite Form Deck: Galvanized- and shop-primed steel sheet.

1. Profile Depth: match existing.

1.3 INSTALLATION

A. Install deck panels and accessories in accordance with SDI standards.

1. Roof Deck: Mechanically fastened.
2. Floor Deck: Mechanically fastened.

1.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner engaged.

B. Tests and Inspections:

1. Special inspections and qualification of welding special inspectors in accordance with SDI QA/QC.
2. Shear Stud Connectors: In accordance with AWS D1.1/D1.1M for stud welding.

END OF SECTION 053100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Slotted channel framing.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.

1.4 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Research Reports: For post-installed anchors.

E. Delegated design engineer qualifications.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

G. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

H. Zinc-Coated Steel Wire Rope: ASTM A741.

1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

I. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.

1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

J. Steel Prestressing Strand: ASTM A416/A416M, Grade 270, low-relaxation, seven-wire, with 0.9-lb/sq. ft. zinc coating.

1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.

K. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated.
2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
3. Cold-Rolled Steel: ASTM A1008/A1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; hot-dip galvanized after fabrication.

L. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

M. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

N. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

O. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

P. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

Q. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).

R. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semired brass).

S. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.

T. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum or stainless steel.
2. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.

D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 0991213 "Exterior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill or punch girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

F. Galvanize miscellaneous framing and supports where indicated.

G. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

1. As indicated.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.8 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.9 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.11 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for ceiling-hung toilet partitions securely to, and rigidly brace from, building structure.

3.3 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Miscellaneous lumber.
5. Miscellaneous plywood at roof.
6. Underlayment under preservative treated wood.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: 19 percent.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

1. UC2: Interior construction not in contact with ground but may be subject to moisture. Include the following items:

a. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.

b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
c. Wood floor plates that are installed over concrete slabs-on-grade.

2. UC3B (Commodity Specification A): Uncoated sawn products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting but with sufficient air circulation for wood to dry. Excludes sawn products not in contact with ground but with ground contact-type hazards. Include the following items:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

3. UC3B (All Other Commodity Specifications): Uncoated products excluding sawn products in exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting. Include the following items:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
5. After treatment, redry boards to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment is not to promote corrosion of metal fasteners.
2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

E. Application: Treat items indicated on Drawings, and the following:

1. Interior concealed blocking and nailers.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 MISCELLANEOUS PLYWOOD AT ROOF

A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated on Drawings but not less than 5/8 inch (16 mm).

2.7 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 or of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.

2.8 MISCELLANEOUS MATERIALS

A. Underlayment Under Preservative Treated Wood: Provide one of the following under preservative treated wood and between any metal construction:

1. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
2. Felt: Type II asphalt saturated organic felt, complying with ASTM D 226 (No. 30) or ASTM D 4869.

B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

1. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking,and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to walls; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

D. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Where wood-preservative-treated lumber is installed adjacent to metal decking or any other metal construction, install continuous flexible flashing separator between wood and metal decking and metal construction.

G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

H. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

D. Install underlayment between preservative treated wood and metal decking or other metal construction material to prevent corrosion.

END OF SECTION 061000

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Details of roof-penetration flashing.

9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Details of special conditions.
11. Details of connections to adjoining work.
12. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

E. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1. Sheet Metal Flashing and Trim: Manufacturers' standard size. Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

D. Qualification Statements: For fabricator.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.

C. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop is to be listed as able to fabricate required details as tested and approved.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Design Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

E. FM Approvals Listing: Manufacture and install roof edge flashings and copings that comply with requirements in FM Approvals 4471 as part of a roofing system and that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, Class 1A-120. Identify materials with name of fabricator and design approved by FM Approvals.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

1. Nominal Thickness: 0.034 inch.
2. Surface: Smooth, flat and with manufacturer's standard clear acrylic coating on both sides.

3. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    b. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    c. Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    d. Metallic Fluoropolymer: Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    e. FEVE Fluoropolymer: Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

C. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Thickness: 0.050 inch.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
    c. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight

in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

d. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

e. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.

4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
6. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
7. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

    a. Color: As selected by Architect from full range of industry colors and color densities.
    b. Color Range: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

8. As-Milled FinishMill.
9. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
10. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.

D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed.

1. Nominal Thickness: 0.0250 inch
2. Surface: Smooth, flat.
3. Exterior Finish: ASTM A480/A480M, No. 2D (dull, cold rolled .

    a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
    b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

        1) Run grain of directional finishes with long dimension of each piece.

2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.3 UNDERLAYMENT

A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.

B. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.

C. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
5. Fasteners for Copper, Zinc-Tin Alloy-Coated Copper, or Copper-Clad Stainless Steel Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
6. Fasteners for Zinc Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

C. Solder:

1. For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet].

1. Material: Stainless steel, 0.0188 inch thick, Copper, 16 oz./sq. ft.
2. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
6. Accessories:

a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.

7. Finish: Mill.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12 ft. long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches wide.
2. Fabricate with scuppers spaced 10 ft. apart, to dimensions required with 4-inch- wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate from the following materials:

    a. Stainless Steel: 0.0188 inch thick.

B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12 ft.- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on] interior leg. Miter corners, solder or weld watertight. Shop fabricate interior and exterior corners.

1. Coping Profile: Fig. 3-4A in accordance with SMACNA's "Architectural Sheet Metal Manual."
2. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
3. Fabricate from the following materials:

    a. Stainless Steel: 0.0250 inch thick.

C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

E. Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

F. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.
2. Copper: 16 oz./sq. ft.

G. Roof-Drain Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 ft. long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches.
2. Lap end joints not less than 12 inches.

B. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

C. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lap joints not less than 2 inches.

D. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of welds.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder metallic-coated steel and aluminum sheet.
3. Do not pretin zinc-tin alloy-coated copper.
4. Do not use torches for soldering.
5. Heat surfaces to receive solder, and flow solder into joint.

a. Fill joint completely.
b. Completely remove flux and spatter from exposed surfaces.

6. Stainless Steel Soldering:

a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
b. Promptly remove acid-flux residue from metal after tinning and soldering.
c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with [riveted and soldered joints] [or] [joints sealed with sealant].
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Fasten gutter spacers to front and back of gutter.
7. Anchor and loosely lock back edge of gutter to continuous [cleat] [eave or apron flashing].
8. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
9. Anchor gutter with [gutter brackets] [straps] [twisted straps] spaced not more than [24 inches] [30 inches] [36 inches] <Insert dimension> apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
10. Anchor gutter with spikes and ferrules spaced not more than [24 inches] [30 inches] <Insert dimension> apart.
11. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. apart. Install expansion-joint caps.
12. Install continuous gutter screens on gutters with noncorrosive fasteners, [removable] [hinged to swing open] for cleaning gutters.

C. Built-in Gutters:

1. Join sections with [riveted and soldered joints] [or] [joints sealed with sealant].
2. Provide for thermal expansion.
3. Slope to downspouts.

4. Provide end closures and seal watertight with sealant.
5. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.

    a. Lap sides minimum of 2 inches over underlying course.
    b. Lap ends minimum of 4 inches.
    c. Stagger end laps between succeeding courses at least 72 inches.
    d. Fasten with roofing nails.
    e. Install slip sheet over underlayment.

6. Anchor and loosely lock back edge of gutter to continuous [cleat] [eave or apron flashing].
7. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 18 inches apart.
8. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 ft. apart. Install expansion-joint caps.

D. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

E. Splash Pans:

1. Install where downspouts discharge on low-slope roofs.
2. Set in [asphalt roofing cement] [or] [elastomeric sealant] compatible with the substrate.

F. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and [solder] [or] [seal with elastomeric sealant] to scupper.
3. Loosely lock front edge of scupper with conductor head.
4. [Solder] [or] [seal with elastomeric sealant] exterior wall scupper flanges into back of conductor head.

G. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below [scupper] [or] [gutter] discharge.

H. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

C. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry

3.6 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans:

1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
2. Pipe and install drain line to plumbing waste or drainage system.

3.7 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.9 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Storefront framing.
2. Manual-swing entrance doors.

B. Related Requirements:

1. Section 084126084413 "Glazed Aluminum Curtain Walls"
2. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.
3. Division 28 Section “Access Control” for access control and activating signaling systems.

1.3 081216PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.

c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

G. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Mockup Testing Submittals:

1. Testing Program: Developed specifically for Project.
2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data: For Installer.

C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Five (5) years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:

a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans of less than 11 feet 8-1/4 inches.

E. Structural: Test according to ASTM E 330/E 330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft..

2. Entrance Doors:

a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, 12 lbf/sq.ft.

H. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:

1. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.35 as determined according to NFRC 200.
3. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 15 as determined according to NFRC 500.

K. Noise Reduction: Test according to ASTM E 90, with ratings determined by ASTM E 1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 30.

L. Windborne-Debris Impact Resistance: Pass missile-impact and cyclic-pressure tests according to ASTM E 1996 for Wind Zone 2.

1. Large-Missile Test: For glazed openings located within 30 feet of grade.
2. Small-Missile Test: For glazed openings located more than 30 feet above grade.

M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

N. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

O. Structural Sealant: ASTM C 1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.3 STOREFRONT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; Trifab 451T or a comparable product by one of the following:

1. EFCO Corporation.
2. Oldcastle Building Envelope.
3. Tubelite Inc.
4. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.

3. Glazing System: Retained mechanically with gaskets on four sides.
4. Glazing Plane: Center.
5. Finish: High-performance organic finish.
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 IMPACT RESISTANT STOREFRONT SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; IR501 UT or a comparable product by one of the following:

1. EFCO Corporation.
2. Oldcastle Building Envelope.
3. Tubelite Inc.
4. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center.
4. Finish: High-performance organic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.5 074213085113ENTRANCE DOOR SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America, an Arconic company; 350/500 Heavy Wall Door or a comparable product by one of the following:

1. EFCO Corporation.
2. Oldcastle Building Envelope.
3. Tubelite Inc.
4. YKK AP America Inc.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware is specified in Section 087100 "Door Hardware."**087111**

2.7 087100**087111**GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.**088000**

C. Glazing Sealants: As recommended by manufacturer.**088000**

D. Structural Glazing Sealants: ASTM C 1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.

1. Color: Color: Clear/Transparent.

E. Weather seal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weather seal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.8 MATERIALS

A. Sheet and Plate: ASTM B 209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

C. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.

D. Structural Profiles: ASTM B 308/B 308M.

E. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.9 ACCESSORIES

A. Automatic Door Operators: Section 087113 "Automatic Door Operators."**084229**

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system <, fabricated from 300 series stainless steel>.

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

F. Rigid PVC Filler.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.11 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.12 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on mockups.

1. Air Infiltration: ASTM E 783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

    a. Perform a minimum of two tests in areas as directed by Architect.

2. Water Penetration: ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Structural-Sealant Adhesion: Test structural sealant according to recommendations in ASTM C 1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.

1. Test a minimum of two areas on each building facade.
2. Repair installation areas damaged by testing.

D. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

THIS PAGE INTENTIONALLY BLANK

SECTION 084523 - 4” INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the insulated, translucent sandwich panel system and accessories as shown and specified. Work includes providing and installing:

1. Flat insulated, translucent sandwich panels
2. Aluminum clamptite installation system
3. Aluminum flashing attached to Skyroofs

1.2 SUBMITTALS

A. Submit manufacturer’s product data. Include construction details, material descriptions, profiles, and finishes of components.

B. Submit shop drawings. Include plans, elevations, and details.

C. Submit manufacturer’s color charts showing the full range of colors available for factory finished exposed aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below.

a. Sandwich panels: 7” x 12” units
b. Factory finished aluminum: 3” long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required (if applicable) are:

a. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
b. Burn Extent (ASTM D 635)
c. Color Difference (ASTM D 2244)
d. Impact Strength (UL 972)
e. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
f. Bond Shear Strength (ASTM D 1002)

g. Beam Bending Strength (ASTM E 72)
h. Insulation U-Factor (NFRC 100)
i. NFRC System U-Factor Certification (NFRC 700)
j. NFRC Visible Light Transmittance (NFRC 202)
k. Solar Heat Gain Coefficient (NFRC or Calculations)
l. Condensation Resistance Factor (AAMA 1503) (Thermally Broken, insulated panels only)
m. Air Leakage (ASTM E 283)
n. Structural Performance (ASTM E 330)
o. Water Penetration (ASTM E 331)
p. Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure (ASTM E2707)
q. Fall Through Resistance (ASTM E 661)
r. Class A Roof Covering Burning Brand (UL 790)
s. UL Listed Class A Roof System (UL 790) (Optional) – Submit UL Card

1.3 CLOSEOUT SUBMITTALS

A. Provide field maintenance manual to include in project maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope, and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural, and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components, and production sandwich panels for conformance with AC177 “Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems” as issued by the ICC-ES.

B. Installer’s Qualifications: Installation shall be by an experienced installer, which has been in the business of installing Kalwall panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope, and type.

1.5 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include span analysis data.

2. Standard panel system shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
3. Structural Loads. Provide system capable of handling the following loads:

    a. Live Load (PSF): 20 PSF
    b. Snow Load (PSF): 5 PSF
    c. Drift Load (PSF): 35 PSF
    d. Wind Load (PSF): +30/-70 PSF Ultimate

B. Deflection Limits:

1. Skyroof/Unit Skylight/Canopy: Limited to L/60 of clear span for each assembly component.

C. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F (43 deg C), ambient; 150 deg F (66 deg C), material surfaces.

D. DELIVERY, STORAGE AND HANDLING

E. Deliver panel system, components, and materials in manufacturer’s standard protective packaging.

F. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer’s storage and handling instructions.

1.6 WARRANTY

A. Provide manufacturer's and installer's written warranties agreeing to repair or replace panel system work, which fails in material or workmanship, within one (1) year from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six (6) months from date of delivery. Failure of material or workmanship shall include deterioration of finish on metal in excess of normal weathering; and defects in accessories; insulated, translucent sandwich panels; and other components of the work

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project subject to compliance with the performance requirements of this specification and submission of evidence thereof. Listing other manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com

2.2 PANEL COMPONENTS

A. Face Sheets:

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.

a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.

2. Interior face sheets:

a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 50 and smoke developed no greater than 450 when tested in accordance with UL 723.
b. Burn extent by ASTM D 635 shall be no greater than 1".

3. Exterior face sheets:

a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south as measured on a white sample, with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
c. Erosion Protection: Integral, embedded-glass erosion barrier.

4. Appearance:

a. Exterior face sheet: Smooth, .22" thick and Greenish blue in color.
b. Interior face sheet: Smooth, 0.14" thick and white Color> in color.
c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core:

1. Thermally Broken Composite I-beam grid core shall be of alloy and temper recommended by manufacturer with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
2. I-beam Thermal break: Minimum 2", thermoset fiberglass composite. Poured and de-bridged thermal break is not acceptable.

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

    a. 50% Relative Humidity at 68° F: 540 PSI
    b. 182° F: 100 PSI
    c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
    d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 4 inches
2. Grid Core Insulation: Fill panel cores with air
3. Panel U-factor by NFRC certified laboratory: 4" thermally broken grid 0.15
4. Visible Light Transmittance (VLT): Select VLT criteria below

    a. Visible LT: 5%.

5. Solar heat gain coefficient 0.14
6. Grid pattern as viewed: Nominal size 12"x24" ; pattern architect selected from mfg standard

B. Standard panels shall deflect no more than 1.9" at 30 PSF in 10'-0" span without a supporting frame by ASTM E 72.

C. Panels shall meet the conditions of acceptance according to ASTM E2707 Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure:

1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 60-min observation period.
3. Absence of evidence of flame, glow, and smoke if the test is terminated prior to the completion of the 60-min observation period.

D. Thermally broken, insulated panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

E. Skyroof/Unit Skylight/Canopy System:

1. Skyroof/Unit Skylight/Canopy system shall pass Class A Roof Burning Brand Test by UL 790.
2. Skyroof/Unit Skylight/Canopy system shall be UL listed as a Class A Roof by UL 790, which requires periodic unannounced factory inspections and retesting by Underwriters Laboratories.

F. Skyroof/Unit Skylight/Canopy System shall meet the fall through requirements of OSHA 1910.21 as demonstrated by testing in accordance with ASTM E 661, thereby not requiring supplemental screens or railings.

2.4 ALUMINUM CLAMPTITE INSTALLATION SYSTEM

A. Aluminum clamptite installation system (Skyroof/Unit Skylight/Canopy):

1. Clamp-tite screw type closure system shall be of extruded aluminum alloy and temper as recommended by manufacturer.
2. Unit Skylight perimeter aluminum clampite installation system at curbs shall be factory sealed to panels.

B. Sealing tape: Manufacturer's standard, pre-applied to aluminum clamptite installation system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum clamptite installation system, excluding final fasteners to the building.

D. Finish:

1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's standard KCRF colors.
2. Mill (optional)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure, and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by sealant manufacturer for this purpose.
2. Where aluminum will contact concrete, masonry, or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by sealant manufacturer.

3.3 INSTALLATION

A. Install the panel system in accordance with the manufacturer's fabrication drawings and suggested installation instructions.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.
3. Seal aluminum clamptite installation system as shown on the manufacturer’s fabrication drawings and suggested installation instructions.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturers fabrication drawings and suggested installation instructions.

3.4 FIELD QUALITY CONTROL (SKYROOF/UNIT SKYLIGHT/WALLS/FIXED WINDOW UNITS)

A. Water Test: Installer to test a representative section of installed materials according to procedures in AAMA 501.2.

B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

3.5 CLEANING

A. Clean the panel system, interior and exterior, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 084523

SECTION 084524 - 4” INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the insulated, translucent sandwich panel system and accessories as shown and specified. Work includes providing and installing:

1. Flat insulated, translucent sandwich panels
2. Aluminum clamptite installation system
3. Aluminum sill flashing

B. SUBMITTALS

C. Submit manufacturer’s product data. Include construction details, material descriptions, profiles, and finishes of components.

D. Submit shop drawings. Include plans, elevations, and details.

E. Submit manufacturer’s color charts showing the full range of colors available for factory finished exposed aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below.

a. Sandwich panels: 7” x 12” units
b. Factory finished aluminum: 3” long sections

F. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

G. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required (if applicable) are:

a. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
b. Burn Extent (ASTM D 635)
c. Color Difference (ASTM D 2244)
d. Impact Strength (UL 972)
e. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
f. Bond Shear Strength (ASTM D 1002)
g. Beam Bending Strength (ASTM E 72)

h. Insulation U-Factor (NFRC 100)
i. NFRC System U-Factor Certification (NFRC 700)
j. NFRC Visible Light Transmittance (NFRC 202)
k. Solar Heat Gain Coefficient (NFRC or Calculations)
l. Condensation Resistance Factor (AAMA 1503) (Thermally Broken, insulated panels only)
m. Air Leakage (ASTM E 283)
n. Structural Performance (ASTM E 330)
o. Water Penetration (ASTM E 331)
p. Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure (ASTM E2707)

1.2 CLOSEOUT SUBMITTALS

A. Provide field maintenance manual to include in project maintenance manuals.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope, and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural, and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components, and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing Kalwall panel systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope, and type.

1.4 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete panel system.

1. When requested, include span analysis data.
2. Standard panel system shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
3. Structural Loads. Provide system capable of handling the following loads:

a. Positive Wind Load (PSF): 28 PSF Ultimate
b. Negative Wind Load (PSF): -38 PSF Ultimate

B. Deflection Limits:

1. Walls: Limited to L/60 of clear span for each assembly component.

C. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F (43 deg C), ambient; 150 deg F (66 deg C), material surfaces.

D. DELIVERY, STORAGE AND HANDLING

E. Deliver panel system, components, and materials in manufacturer’s standard protective packaging.

F. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer’s storage and handling instructions.

1.5 WARRANTY

A. Provide manufacturer's and installer's written warranties agreeing to repair or replace panel system work, which fails in material or workmanship, within one year from the commencement date. The commencement date of the warranty shall be the date of substantial completion, but no more than six months from date of delivery. Failure of material or workmanship shall include deterioration of finish on metal in excess of normal weathering; and defects in accessories; insulated, translucent sandwich panels; and other components of the work

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project subject to compliance with the performance requirements of this specification and submission of evidence thereof. Listing other manufacturers’ names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com

2.2 PANEL COMPONENTS

A. Face Sheets:

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.

    a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
    b. Face sheets shall not deform, deflect, or drip when subjected to fire or flame.

2. Interior face sheets:

    a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 50 25 and smoke developed no greater than 450 when tested in accordance with UL 723.
    b. Burn extent by ASTM D 635 shall be no greater than 1".

3. Exterior face sheets:

    a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south as measured on a white sample, with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
    b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.
    c. Erosion Protection: Integral, embedded-glass erosion barrier.

4. Appearance:

    a. Exterior face sheet: Smooth, .22" thick and greenish blue in color.
    b. Interior face sheet: Smooth, 0.14" thick and white in color.
    c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core:

1. Thermally Broken Composite I-beam grid core shall be of alloy and temper recommended by manufacturer with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
2. I-beam Thermal break: Minimum 2", thermoset fiberglass composite. Poured and de-bridged thermal break is not acceptable.

C. Laminate Adhesive:

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

    a. 50% Relative Humidity at 68° F: 540 PSI

b. 182° F: 100 PSI
c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 4 inches
2. Grid Core Insulation: Fill panel cores with air
3. Panel U-factor by NFRC certified laboratory: 4” thermally broken grid 0.15
4. Visible Light Transmittance (VLT):

    a. Visible LT: 5%

5. Solar heat gain coefficient 0.14
6. Grid pattern as viewed: Nominal size 12”x24” ; pattern architect selected from mfg standard.

B. Standard panels shall deflect no more than 1.9” at 30 PSF in 10’-0” span without a supporting frame by ASTM E 72.

C. Panels shall meet the conditions of acceptance according to ASTM E2707 Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure:

1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 60-min observation period.
3. Absence of evidence of flame, glow, and smoke if the test is terminated prior to the completion of the 60-min observation period.

D. Thermally broken, insulated panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

2.4 ALUMINUM CLAMPTITE INSTALLATION SYSTEM

A. Aluminum clamptite installation system:

1. Thermally Broken-Flat clamptite screw type closure system shall be of extruded aluminum alloy and temper as recommended by manufacturer.

B. Sealing tape: Manufacturer's standard, pre-applied to aluminum clamptite installation system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum clamptite installation system, excluding final fasteners to the building.

D. Finish:

1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's standard KCRF colors.
2. Mill (optional)
3. Anodized

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure, and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by sealant manufacturer for this purpose.
2. Where aluminum will contact concrete, masonry, or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by sealant manufacturer.

3.3 INSTALLATION

A. Install the panel system in accordance with the manufacturer's fabrication drawings and suggested installation instructions.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.
3. Seal aluminum clamptite installation system as shown on the manufacturer’s fabrication drawings and suggested installation instructions.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturers fabrication drawings and suggested installation instructions.

3.4 FIELD QUALITY CONTROL

A. Water Test: Installer to test a representative section of installed materials according to procedures in AAMA 501.2.

B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

3.5 CLEANING

A. Clean the panel system, interior and exterior, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 084524

SECTION 087100 - FACILITY GUIDELINES FINISH HARDWARE

PART 1 - GENERAL

1.1 WARRANTY

A. Provide a warranty that items furnished under this section of the specification shall be free of defects in material and workmanship and perform for a period of one (1) year after substantial completion. Adjust, repair or replace items not fulfilling this warranty at no further expense to Owner. Exceptions to the one (1) year requirement are as follows for mechanical hardware:

1. Continuous Hinges – limited lifetime
2. Locks – ten (10) years
3. Door closers – thirty (30) years.
4. Exit devices - five (5) years.

B. Provide a warranty that electrified items furnished under this section of the specification shall be free of defects in material and workmanship and perform for a period of one (1) year after substantial completion.

PART 2 - PRODUCTS

2.1 ITEM INFORMTION

A. Items include but are not limited to the following:

1. Levers and Trim
2. Locks and Latches
3. Cylinders, Cores and Keying
4. Door Closers
5. Hinges, Continuous Hinges and Pivots
6. Exit devices
7. Mullions
8. Flush bolts
9. Door silencers
10. Stops, overhead controls
11. Protection plates
12. Push/pull plates
13. Thresholds, gasketing, and door bottoms
14. Miscellaneous trim and accessories
15. Electrified hardware, power supplies, system diagrams

2.2 ACCEPTABLE MANUFACTURERS

A. The numbers and symbols used herein, establish the quality, merit, and function required and have been selected from the following manufacturers:

1. ABH
2. BEST
3. Glynn-Johnson
4. Hager
5. Ives
6. LCN
7. McKinney
8. National Guard Products (NGP)
9. Precision Hardware Inc. (PHI)
10. Stanley
11. Stanley Commercial
12. Trimco

2.3 SUBSTITUTIONS

A. Unless otherwise approved in writing, provide only the specified products are allowed for this facility.

B. Requests for substitution shall be submitted in writing and approved by Pflugerville ISD in writing before authorization by the Architect.

C. Requests for substitution shall be accompanied by 2 copies of the manufacturers' literature, highlighting the conformance to this standard.

2.4 CONTINUOUS HINGES

A. Continuous hinges shall be manufactured of aluminum alloy with anodized finish. Hinge shall be manufactured to template screw locations. Hinges shall contain bearing surfaces.

B. Hinges profiles shall be heavy duty and of the type and size recommended by the manufacturer.

C. Approved manufacturers:

1. Stanley
2. Hager

2.5 HINGES

A. Hinges shall be five-knuckle, standard and heavy duty, ball bearing, button tip, full mortise, templated.

B. Hinge profiles shall be the quantity, type, size and weight recommended by the manufacturer unless specified heavier duty.

C. Exterior hinges shall be stainless steel or non-ferrous to closely match adjacent hardware finishes.

D. Hinges at exterior and interior out swinging doors shall contain non-removable pins (NRP.)

E. Hinges at fire rated doors shall be steel-based with finish to match adjacent hardware or stainless steel. Hinges for fire rated, paint grade interior doors may be steel-based, prime coated.

F. Approved manufacturers:

1. BEST
2. Hager

2.6 LOCKS AND LATCHES

A. Locks and latches shall be cylindrical type only.

B. Locksets, latch sets, electrified locksets, cylinders, and trim shall be of one manufacturer, as listed, for continuity of design and consideration of warranty.

C. Cylindrical locks shall conform to BHMA A156.2 4000 Series Grade 50,000,000 cycle test.

D. Cylindrical locks shall be extra heavy duty and UL listed.

E. Approved manufacturers:

1. BEST 93K Series, no substitution
2. All Locks to shall be “D’ Storeroom Function 93K7D15D-S3-626

F. Levers shall be heavy duty, matching BEST 15D Lever/Rose.

G. Strike plates for mortise and cylindrical locks and latches shall conform to American National Standards Institute (ANSI) A115.2, 4-7/8”, as recommended by the manufacturer. Lip length shall be minimally sufficient to protect the door and frame trim. Include a dust box behind each strike.

H. Deadbolts

1. Cylindrical and tubular deadbolts shall have no less than 1” projection.
2. Construction shall be solid stainless steel; or, solid brass or bronze with a hardened free-floating steel pin to prevent sawing.
3. Backset shall be 2-3/4”.
4. Approved manufacturers:

    a. BEST 8T Series

5. Turn levers for tubular deadbolts shall meet Texas Accessibility Standards (TAS) guidelines for current ADA requirements.

6. Tubular deadbolts shall be capable of receiving interchangeable cores cylinder cores, compatible with the project requirements for keying.
7. Strikes for tubular deadbolts shall be the standard flat strike with no lip, recommended by the manufacturer.
8. Cylinder collars for mortise and tubular deadbolts shall be solid, wrench-resistant, free-rotating.

2.7 CYLINDERS, CORES AND KEYING

A. Cylinders for mortise locks, cylindrical locks, tubular deadbolts, exit devices, key switches, key-removable mullions, and padlocks shall be keyed to the system in 2.7.2.

B. Cylinders shall be keyed to the existing facility key system, including grandmaster and control system. BEST Lock Cormax key system, grandmaster and control system.

C. Coordinate keying requirements for additions and renovations of existing facilities with Facilities Lock shop.

D. Keying shall be coordinated with BEST Access Systems' Key System Specialist and as directed as soon as locks and cylinders have been ordered for the project.

E. Furnish construction cores, (10) each construction master keys and (2) each construction control keys for the project to the jobsite.

F. Permanent cores, cut keys, grandmaster and master keys and control keys shall be shipped directly from the manufacturer via registered mail to:

1. Pflugerville ISD:

a. Randy Mendoza
2021 Crystal Bend Drive
Pflugerville, TX 78660
512-594-0278

G. Visual Key Control

1. Permanent cores and cut keys shall have VKC visual key control using standard Door and Hardware Institute key system nomenclature or as required by Facilities Lock shop.
2. Cylinders shall be stamped with the key symbol on the side. Keys shall be stamped with key symbol.

2.8 DOOR CLOSERS

A. Door closers shall be surface mounted, heavy duty, full rack and pinion liquid (hydraulic) type, with cast iron cylinders, capable of controlling the door through 180 degrees of swing. Provide full covers of non-ferrous, non-corrosive material painted in a finish to match the adjacent hardware.

B. Closers shall be adjusted by key valves. Furnish six (6) adjusting keys.

C. Closers shall have separate valves for closing speed, latch speed, and backcheck control as standard features.

D. Spring power of each closer will be adjustable for a minimum of 50% over rated and shall be capable of meeting TAS and building code accessibility requirements to conform to ADA requirements.

E. Provide closer arms, brackets, shoes and options necessary to install closers on the interior side of exterior doors while meeting the conditions of the project.

F. Provide special brackets and templating to avoid conflicting mounting locations with overhead stops.

G. Provide extra duty parallel arms wherever parallel arms are required.

H. Provide extra duty parallel arms in lieu of regular arms for doors even when the placement is on the corridor side of interior doors.

I. When wall stops, overhead stops and floor stops cannot be used, extra duty parallel arms with cushioning stops built into the arm shoes shall be provided.

J. Approved manufacturers All doors to have (Interior and Exterior)

1. BEST EHD9000/HD7000 Series
2. LCN 4040/1400

2.9 EXIT DEVICES

A. Exit devices for panic hardware shall be UL listed Panic Hardware. Exit devices for fire rated doors shall be UL listed Fire Exit Hardware.

B. Exit devices shall be touch bar style, with deadlocking latches, and sloped end caps.

C. Provide rim exit devices only for this facility. In lieu of surface or concealed vertical rods, provide (2) rim devices and (1) removable mullion for pairs of doors. Exit Devices to have hex key dogging.

D. Electrified devices and trim to be the same series and design as mechanical devices and trim.

E. Approved manufacturers:

1. Precision (PHI) 2000 Series 630 or Von Duprin 99/98 630 stainless steel finish,
2. Electrified exit devices to be Precision (PHI) MLR Motorized Latch Retraction less dogging.
3. All Classrooms requiring exit device hardware to have Storeroom Function Exit Devices (Less Dogging)

2.10 MULLIONS

A. Removable mullions shall be 2” x 3” steel.

B. Provide a set of mullion stabilizers on each exit device side per pair of doors.

C. Mullions shall be key-removable using a key cylinder that can be keyed to the facility keying requirements in 2.7.

D. Provide fire rated mullions at fire rated openings.

E. Approved manufacturers:

1. PHI KR822

2.11 LATCH GUARDS

A. Provide latch guards for locking out swinging exterior doors.

B. Latch guards shall be cast bronze or brass, finished to match adjacent hardware.

C. Include spacers for long-lipped strikes.

D. Approved manufacturers:

1. Trimco 5000 or approved equivalent

2.12 FLUSH BOLTS

A. Edge-mounted flush bolts shall be the manufacturer’s recommend type and style for wood, aluminum and hollow metal doors.

B. Provide UL listed fire rated flush bolts at labeled openings.

C. Provide strikes head mounted and floor mounted for flush bolts.

D. Provide dust proof strikes at finished floor conditions.

E. Provide threshold mounted dust proof strikes where applicable.

2.13 COORDINATORS

A. Coordinators shall be bar-type coordinators, sized for door opening per manufacturer’s recommendation.

B. Openings with coordinators shall receive filler bars, closer brackets and carry-open bars.

2.14 PUSH AND PULLS

A. Push plates and pull plates shall be 4” x 16”.

B. Cut push plates and pull plates for key cylinders where conflicting mounting heights occur.

2.15 PROTECTION PLATES

A. Kick plates and armor plates shall be stainless steel, minimum .050” thick, in sizes recommended by the Door & Hardware Institute standards for single doors and pairs of doors.

B. Kick plates shall be 10” high.

C. Armor plates shall be 34” high.

D. Provide protection plates with UL listings for fire rated openings.

2.16 DOOR STOPS

A. Provide a door stop at every door leaf.

B. Provide cast brass, bronze or stainless steel wall stops at interior doors. Wall stops shall be convex rubber for locks without pushbuttons and concave for locks with pushbuttons in the lever.

C. Provide overhead stops or cushioning closer arm stops where wall mounted stops cannot be installed due to door/frame/wall conditions or other obstructions.

D. Overhead stops shall be heavy duty, surface or concealed mounted.

1. Overhead stops shall be coordinated with closer templating

E. Provide floor stops where they cannot pose a trip hazard and only when no other door stop can be installed.

2.17 THRESHOLDS AND GASKETING

A. Provide thresholds, gasketing, rain drips, astragals, sound seals, light seals and smoke seals applicable for the project.

B. Comply with TAS and ANSI Standard A117.1 for ADA compliance.

2.18 FASTENERS

A. Except as noted otherwise, provide the manufacturers’ recommended and furnished fasteners throughout.

B. Fasteners for aluminum entry system door pulls shall be through-bolted.

C. Fasteners for exit devices and door closers shall be hex nuts and bolts.

D. Anchors for thresholds shall be machine screw/lead expansion shields or lag bolt anchors.

E. Fasteners for wall stop shall be machine screw and toggle bolt for hollow walls, sheet metal screws for stud-reinforced placement and machine screw/lead expansion shields for grouted concrete walls.

2.19 FINISHES

A. Except as stated otherwise, this project shall conform to brushed stainless steel 630 (US-32D) and brushed chrome 626 (US-26D) throughout.

B. Mullions, door closers shall be spray painted or powder coated to aluminum color, closely matching adjacent door hardware.

C. Exit devices shall be 630, stainless steel. For manufacturers that don’t produce a true stainless steel finish throughout the exposed surfaces, the minimum acceptable portion shall be a stainless steel push pad.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ensure accuracy for installation of cylindrical locksets. Unless doors are factory-furnished with the additional mounting holes for through bolts, provide one through-bolt drill kit for each 50 doors, or fraction thereof. Through-drill two additional mounting holes per lock, per hardware manufacturer’s requirements.

B. Install manufacturer’s recommended center case bracket/reinforcement to the center case assemblies on exit devices, if available by the manufacturer.

C. Install exit devices level per ADA requirements.

D. Post construction walk-thru between awarded general contractor, hardware manufacturer and Pflugerville ISD represented to be conducted at conclusion of hardware installation.

3.2 MOUNTING HEIGHTS

A. Comply with Texas Accessibility Standards (TAS) guidelines ANSI Standard A117.1 standards for current ADA requirements.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 088853 "Security Glazing."

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Insulating glass.

C. Glazing Accessory Samples: For sealants , in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.7 PRECONSTRUCTION TESTING

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Basic Wind Speed: 115 mph .
    c. Importance Factor: 3.0.
    d. Exposure Category: B.

2. Probability of Breakage for Sloped Glazing: For glass sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

D. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 3 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet of grade.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.

3. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
4. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

G. Acoustic Performance:

1. Exterior Glazing: 28 OITC.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

B. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."

C. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

C. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

D. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

E. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four (4) days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Tinted Insulating Glass Type :

1. Basis-of-Design Product: none: meet or exceed requirements below.
2. Overall Unit Thickness: 1 inch
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Tinted fully tempered float glass.
5. Tint Color: Gray
6. Interspace Content: Air.
7. Indoor Lite: Clear fully tempered float glass.
8. Low-E Coating: Pyrolytic or sputtered on second surface.
9. SGHC: .25 maximum.
10. Safety glazing required.

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing systems.
2. Suspension systems.
3. Grid suspension systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Framing systems.
2. Suspension systems.
3. Grid suspension systems.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For high-strength steel studs and tracks and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

E. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. minimum as required by the IBC.

F. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of inches.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal unless otherwise indicated
2. Protective Coating: Comply with ASTM C645 AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

    a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220 and ASTM C645, Section 10.

1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
2. Depth: As indicated on Drawings See "High-Strength Steel Studs and Tracks" Article in the Evaluations for information about high-strength steel studs and tracks.

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.0329 inch.

D. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base-Steel Thickness: 0.0296 inch.
2. Depth: As indicated on Drawings.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 AC193AC58 or AC308 as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Type: Torque-controlled, expansion anchor.
c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: 0.0296 inch.
b. Depth: As indicated on Drawings.

3. High-Strength Steel Studs and Tracks:

a. Minimum Base-Steel Thickness: 0.0180 inch
b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: 7/8 inch deep.

a. Minimum Base-Steel Thickness: 0.0296 inch.

2.4 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF FRAMING SYSTEMS

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c, unless otherwise indicated.
2. Multilayer Application: 16 inches o.c, unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLATION OF SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support

3.6 INSTALLATION OF GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.7 FIELD QUALITY CONTROL

A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Tile backing panels.
4. Texture finishes.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
4. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
5. Section 092613 "Gypsum Veneer Plastering" for gypsum base for veneer plaster and for other components of gypsum-veneer-plaster finishes.
6. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Flexible gypsum board.
4. Gypsum ceiling board.
5. Foil-backed gypsum board.
6. Abuse-resistant gypsum board.
7. Impact-resistant gypsum board.
8. Mold-resistant gypsum board.
9. Gypsum board, Type C.
10. Glass-mat interior gypsum board.
11. Acoustically enhanced gypsum board.
12. Skim-coated gypsum board.
13. Exterior gypsum soffit board.
14. Glass-mat gypsum sheathing board.
15. Glass-mat, water-resistant backing board.

16. Cementitious backer units.
17. Water-resistant gypsum backing board.
18. Interior trim.
19. Exterior trim.
20. Aluminum trim.
21. Joint treatment materials.
22. Laminating adhesive.
23. Sound-attenuation blankets.
24. Acoustical sealant.
25. Textured finishes.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

D. Samples for Initial Selection: For each type of trim accessory indicated.

E. Samples for Verification: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.3 MOCKUPS

A. Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.
b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

D. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested in accordance with ASTM C1629/C1629M.

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 2Level 3 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 2 requirements.
5. Long Edges: Tapered.
6. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

E. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Exterior Gypsum Soffit Board: ASTM C1396/C1396M, with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

B. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

2.6 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Thickness: As indicated on Drawings.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.7 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.
    h. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches high.

B. Exterior Trim: ASTM C1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.8 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.9 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

2.10 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested in accordance with ASTM E84.

1. Texture: Fine

C. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.

1. Texture: Orange peel

D. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.

1. Application Thickness: 1/2 inch.
2. Surface-Burning Characteristics: As determined by testing identical products in accordance with ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

3. NRC: 0.55 in accordance with ASTM C423.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Type X: Vertical surfaces unless otherwise indicated.
3. Ceiling Type: Ceiling surfaces.
4. Foil-Backed Type: As indicated on Drawings.
5. Abuse-Resistant Type: As indicated on Drawings.
6. Impact-Resistant Type: As indicated on Drawings.
7. Mold-Resistant Type: As indicated on Drawings.
8. Type C: As indicated on Drawings.
9. Glass-Mat Interior Type: As indicated on Drawings.
10. Acoustically Enhanced Type: As indicated on Drawings.
11. Skim-Coated Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.

1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.

2. Bullnose Bead: Use where indicated on Drawings.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated on Drawings.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.8 APPLICATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.9 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porcelain tile.
2. Tile backing panels.
3. Crack isolation membranes.
4. Setting material.
5. Grout materials.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for tile backing panels.

1.2 DEFINITIONS

A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Large Format Tile: Tile with at least one edge 15 inches or longer.

D. Module Size: Actual tile size plus joint width indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces. Show thresholds.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.

D. Samples for Verification:

1. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.

2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal flooring transitions 6-inch lengths.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product, including product use classification.

D. Product Test Reports:

1. Tile-setting and -grouting products.
2. Certified porcelain tile.
3. Slip-resistance test reports from qualified independent testing agency.

E. Field Quality-Control Reports: Water test reports of membrane in wet areas.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer employs at least one installer for Project that has completed the Advanced Certification for Tile Installers (ACT) certification for installation of large format tile.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 WARRANTY

A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.

1. Warranty Period: Five (5) years from date of Product Purchase.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
2. Obtain underlayment from manufacturer of setting and grouting materials.
3. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
4. Obtain joint sealants from manufacturer of setting and grouting materials.

C. Accessory Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.
2. Backer units.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 PORCELAIN TILE

A. Porcelain Tile Type PT-03: Unglazed.

1. Concept Surfaces – Bellla https://conceptsurfaces.com/product/bella/
2. Certification: Tile certified by the Porcelain Tile Certification Agency.
3. Face Size: 12”x24”.
4. Face Size Variation: Rectified.
5. Thickness: 3/8 inch
6. Product Use Classification: Interior, Wet (IW.
7. Tile Color, Glaze, and Pattern: See Drawings.
8. Grout Color: As selected by Architect from manufacturer's full range .
9. Precoat with temporary protective coating.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch across nominal 4-inch dimension.

2.4 GLAZED WALL TILE

A. Glazed Wall Tile Type PT-01:

1. Dal-Tile Rigid Clay https://www.daltile.com/products/wall/rigid-clay
2. Module Size: 12”x24”
3. Face Size Variation: Rectified.
4. Thickness: 3/8 inch
5. Tile Color and Pattern: Refer to drawings
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Mounting:

    a. Factory, back mounted.
    b. Pregrouted sheets of tiles are factory assembled and grouted with manufacturer's standard white silicone rubber.
    c. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: As indicated on Drawings.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 CRACK ISOLATION MEMBRANES

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Crack Isolation Membrane, Polyethylene Sheet: Polyethylene faced on both sides with polyester fabric.

C. Crack Isolation Membrane, Asphaltic Sheet: Self-adhering, modified-asphalt sheet with fabric reinforcement facing.

D. Crack Isolation Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with continuous fabric reinforcement.

2.7 SETTING MATERIALS

A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.1.

B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

C. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or] styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.

D. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting and adhesive materials for installations indicated.

B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.

C. Metal Flooring Transitions: Profile designed specifically for flooring applications; height to match tile and setting-bed thickness.

1. Schluter
2. Description: Tapered

3. Material and Finish: Metallic or combination of metal and PVC or neoprene base; polished nickel anodized aluminum exposed-edge material.

D. Metal Edge Trim: Profile designed for wall terminations and edge protection.

1. Description: L-shaped.
2. Terminations: End caps Outside corners matching edge-protection profile.
3. Material and Finish: Polished nickel anodized aluminum

E. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.

F. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

G. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.

F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

D. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

E. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.
    c. Tile floors consisting of rib-backed tiles.

2. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
4. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
5. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

    a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
    b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
    c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

F. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

G. Metal Flooring Transitions: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile

H. Metal Wall Trim: Install at locations indicated on Drawing details.

I. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 FIELD QUALITY CONTROL

A. Water Test:

1. Test of waterproofing membrane in showers and similar areas to be performed by Installation Contractor before setting tile.

a. Perform test after 24 hours of waterproof membrane installation.
b. Insert test plug in drain or waste line.
c. Fill shower base with water, high enough that the membrane-to-drain connection and floor-to-wall transition can be evaluated, and mark wall.
d. Check for leaks after 24 hours.

2. Test to be witnessed by Architect.

B. Nonconforming Work:

1. Waterproof membrane will be considered defective if water level has dropped.
2. Remove and replace defective components and retest.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles.
2. Metal suspension system.
3. Accessories.
4. Metal edge moldings and trim.

B. Related Requirements:

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical tiles.
2. Metal suspension system.
3. Accessories.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Initial Selection: For components with factory-applied finishes.

D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Tiles: Set of full-size Samples of each type, color, pattern, and texture.
2. Concealed Suspension-System Members: 6-inch- long Sample of each type.
3. Seismic Clips: Full size.

E. Delegated Design Submittals: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

a. Lighting fixtures.
b. Diffusers.
c. Grilles.
d. Speakers.
e. Sprinklers.
f. Access panels.

7. Show operation of hinged and sliding components adjacent to acoustical tiles.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical tile ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.

2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Suspended Acoustical Tile Ceiling System: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.

B. Source Limitations for Directly Attached Acoustical Tile Ceiling Tile: Obtain each type of acoustical ceiling tile from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.

B. Seismic Performance: Suspended ceilings to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL TILES ACT-01

A. Armstrong World Industries

B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E1264 classifications as designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide tiles as follows:

1. Type and Form, Type III: Mineral base with painted finish; School Zone Fine Fissured
2. Pattern: School Zone Fine Fissured

D. Color: White.

E. Edge/Joint Detail: tegular.

F. Thickness: 3/4 inch.

G. Modular Size: As indicated in a schedule.

H. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM ACT-01

A. Armstrong Industries Prelude XL

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, fully concealed, metal suspension system and accessories of type, structural classification, and finish indicated that complies with applicable requirements in ASTM C635/C635M.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" in accordance with ASTM C635/C635M.

C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.

1. Fire Rating: As indicated on Drawings.
2. Structural Classification: Intermediate-duty system.
3. Access: Upward and side pivoted, with initial access openings of size indicated below and located throughout ceiling within each module formed by main and cross runners, with additional access available by progressively removing remaining acoustical tiles.

a. Initial Access Opening: In each module, As indicated on Drawings.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection, Carbon Steel: Components zinc plated in accordance with ASTM B633, Class SC 1 (mild) service condition.
c. Corrosion Protection, Stainless Steel: Components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E1190, conducted by a qualified testing and inspecting agency.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.

3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch- diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

2.6 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended in writing by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

B. Staples: 5/16-inch- long, divergent-point staples.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before adhesively bonding tiles to wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

C. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. Install suspended acoustical tile ceilings in accordance with ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems in accordance with tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges of tiles so tile-to-tile joints are interlocked.

1. Fit adjoining tiles to form flush, tight joints. Scribe and cut tiles for accurate fit at borders and around penetrations through ceiling.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tiles and moldings, spaced 12 inches o.c.
3. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Directly Attached Ceilings: Install bottom surface of tiles to a tolerance of 1/8 inch in 12 feet and not exceeding 1/4 inch cumulatively.

C. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage] a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI 7.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical tile ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 095423 - LINEAR METAL CEILINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Linear metal ceilings.

B. Suspended metal support system and perimeter trim.

1.2 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies

B. Section 095100 - Acoustical

C. Section 265100 - Interior Lighting: Luminaires.

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

C. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2018.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2022.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

G. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

H. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

I. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

J. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

M. ASTM E413 - Classification for Rating Sound Insulation; 2022.

N. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.5 SUBMITTALS

A. Product Data: Furnish for component profiles.

B. Shop Drawings: Indicate reflected ceiling plan.

1. Seismic Design: Include seal and signature of design professional on each drawing.

C. Samples: Two samples 6” by12” inch in size showing color and finish of exposed to view components.

D. Designer's qualification statement.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements for additional provisions.
2. Extra Linear Panels: One, standard length.

1.6 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section.

1. Minimum 5 years documented experience.
2. Approved by metal ceiling manufacturer.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.8 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 - PRODUCTS

2.1 LINEAR METAL CEILING ASSEMBLIES

A. Linear Metal Baffle Assembly Type LMBA-1 Item No.B103004:

1. Baffle Assemblies: Barz Design Solutions.
2. Layout: As indicated on drawings.
3. Finish Type:

a. Saranté Colors: S-15 Blond Pear.

4. Standard Perforations Pattern: SD07.
5. Suspension Grid: Semi-concealed, with CP slotted main tees and DX cross tees.

2.2 DESIGN REQUIREMENTS

A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

2.3 PERFORMANCE REQUIREMENTS

A. Design for maximum deflection of 1/360 of span.

B. Design to support imposed loads of indicated elements without eccentric loading of supports. Where supported elements may induce rotation of ceiling system components, provide stabilizing reinforcement.

C. Surface Burning Characteristics: Flame spread index of 25, smoke developed index of 50, when tested in accordance with ASTM E84.

2.4 COMPONENT PRODUCTS

A. Linear Metal Baffle Assemblies: Multiple baffle elements assembled into panels (cassettes) and attached to underside of suspension members.

1. Baffle Profiles: B103004.
2. Cassette Configuration: As indicated on drawings.
3. Spacing Between Cassettes: As indicated on drawings.
4. Material: Aluminum sheet, ASTM B209/B209M.
5. Perforations Pattern: SD07.
6. Finishes:

a. Applied PVC-Free Laminate Finish: Faux-Wood USG Ceilings Plus Saranté laminate.

1) Color: S15 Blond Pear.

b. Monochrome Painted Finish: Manufacturer's standard color.

1) Color: Matte Black.

7. Installation: Design system to allow every cassette to provide access to ceiling plenum. Panels designed for progressive access are not permitted.
8. Mounting Assemblies: Manufacturer's standard backer channels attached to back of cassettes.

a. Mount heavy-duty torsion springs on backer channels to allow downward movement of baffles without potential for damage to baffle face or hinge assembly. Do not attach springs directly to individual baffles.
b. Use the number of backer bars required to transfer the dead load of each cassette to the supporting grid within its structural capabilities.

9. Sound-Absorptive Backer: Manufacturer's standard “Ultrasorb” recycled cotton fiber material, factory-laminated to backside of the perforated panels in sufficient thickness to achieve specified NRC rating for the panels.

    a. Installation: Fill-in; inside each baffle.
    b. Installation: Lay-in; on top of each cassette.
    c. Thickness, Density, and Acoustical Performance: 1 inch thick with density of 1.5 pcf, for NRC 0.75 (25.4 mm thick with density of 24 kg/cu m, for NRC 0.75).

10. Products:

    a. USG Corporation; Barz Design Solutions: www.usg.com/ceilings/#sle.
    b. Substitutions: Not permitted.

B. Suspension Systems:

1. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with hold down clips as required.

    a. Materials:

        1) Steel Grid: ASTM A653/A653M G30 coating, unless otherwise indicated.

2. Semi-Concealed Acoustical Suspension System: Hot-dipped galvanized steel grid and cap.

    a. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
    b. Recycled Materials Content: Classified as containing greater than 50% total recycled content. Available for specific sizes and lengths.
    c. Profile: Tee; 15/16 inch (24 mm) face width.
    d. Finish: Baked enamel.
    e. Color: Black.
    f. Cassettes Installation: Baffles installed from below by inserting torsion springs into slots in faces of main runners of ceiling grid.
    g. Products:

        1) USG Corporation; 15/16 Inch suspension system, with CP slotted main tees and DX cross tees: www.usg.com/ceilings/#sle.
        2) Substitutions: Not permitted.

2.5 ACCESSORIES

A. Support Channels, Carriers, and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.

1. Concealed Suspension:

a. Suspension Wire: Steel, annealed, galvanized finish, 12 gage, 0.0808 (2.05 mm) diameter.

C. Hold-Down Clips: Manufacturer's standard clips to suit application.

D. Miscellaneous Accessories: Manufacturer's standard filler strips, perimeter trim, splice plates required for complete installation of system.

E. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.

F. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.

G. Touch-Up Paint for Exposed Surfaces: Type and color to match linear panels and suspension system grid and trim elements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that field measurements are as indicated on shop drawings.

D. Start of installation constitutes acceptance of project conditions.

3.2 PREPARATION

A. Coordinate the location of hangers with other work.

B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

C. Install after major above-ceiling work is complete.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented by this section.

B. Install hangers and inserts coordinated with overhead work. Provide additional hangers and supports as required.

C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

D. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

E. Locate system on room axis according to reflected ceiling plan.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts. facility services, or equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Form expansion joints as detailed. Form to accommodate plus or minus 1 inch (25 mm) movement. Maintain visual closure.

L. Install unopposed tee attachment clips at appropriate locations to enable installation of acoustical units in an ashlar pattern.

M. Edge Moldings: Install at intersection of ceiling and vertical surfaces and penetrations, using components of maximum length, set level. Provide edge moldings at junction with other ceiling finishes. Miter corners. Provide preformed edge closures to match bullnosed cornered partitions.

1. Install in bed of acoustical sealant.
2. Use longest practical lengths.
3. Overlap and rivet corners.

3.4 INSTALLATION - LINEAR METAL COMPONENTS:

A. Install linear panels, baffles, and other system components in accordance with manufacturer's instructions.

B. Stagger end joints minimum 12 inches (300 mm).

C. Align end joints.

D. Butt interior end joints tight.

E. Set exterior end joints with 1/16 inch (2 mm) gap for expansion and contraction.

F. Provide expansion joints to accommodate plus or minus 1 inch (25 mm) movement and maintain visual closure.

G. Field miter corners at changes in panel direction.

H. Install filler strips between linear panels at interior locations.

I. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.

J. Where bullnose masonry units occur, install radiused closures to fit edge molding.

K. Install end caps at sight-exposed ends of linear panels.

L. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

M. Insulation: Install above panel members; fit tight between grid members ; place insulation with facing side down.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

C. Maximum Variation From Dimensioned Position: 1/4 inch (6 mm).

3.6 CLEANING

A. Clean polished surfaces.

B. Replace damaged or abraded components.

END OF SECTION 095423

SECTION 099123 - INTERIOR PAINTING

1.1 SUSTAINABILITY REQUIREMENTS

A. [**LEED 2009 NC**] [**LEED 2009 CI**] [**LEED 2009 CS**] [**LEED 2009 for Schools**] [**LEED v4**] [**IgCC**] [**Green Globes**]:

1. Low-emitting paints and coatings.
2. Product declarations.

1.2 SUMMARY

A. Primers.

B. Finish coatings.

C. Floor sealers and paints.

D. Dry-fall coatings.

1.3 QUALITY ASSURANCE

A. Mockups for each color and finish.

1.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner engaged.

1.5 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex system.
2. Latex over latex aggregate system.
3. Latex aggregate system.
4. Institutional low-odor/VOC latex system.
5. High-performance architectural latex system.
6. Water-based light-industrial coating system.
7. Concrete stain system.

B. Concrete Substrates, Traffic Surfaces:

1. Latex floor enamel system.
2. Alkyd floor enamel system.
3. Concrete stain system.

4. Water-based concrete floor sealer system.
5. Solvent-based concrete floor sealer system.

C. Cement Board Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Alkyd system.

D. Clay Masonry Substrates:

1. Latex system.
2. Latex aggregate system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light-industrial coating system.
6. Alkyd system.

E. CMU Substrates:

1. Latex system.
2. Latex aggregate system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light-industrial coating system.
6. Alkyd system.

F. Steel Substrates:

1. Latex system, alkyd primer.
2. Latex over shop-applied quick-drying shop primer system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light-industrial coating system.
6. Water-based light-industrial coating system over epoxy primer system.
7. Water-based dry-fall system.
8. Water-based dry fall over shop-applied quick-drying shop primer system.
9. Alkyd system.
10. Alkyd over surface-tolerant primer system.
11. Quick-dry enamel system
12. Alkyd dry-fall system.
13. Alkyd dry fall over quick-drying primer system.
14. Aluminum paint system.

G. Galvanized-Metal Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.

3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Water-based dry-fall system.
6. Alkyd over cementitious primer system.
7. Alkyd dry-fall system (cementitious primer).
8. Aluminum paint system.

H. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Alkyd system.

I. Copper Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Alkyd system.

J. Stainless Steel Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Alkyd system.

K. Exposed Wood Framing:

1. Latex over latex primer system.
2. Latex over alkyd primer system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Alkyd system.

L. Finish Carpentry: [**Wood trim**] [**Doors**] [**Windows**] [**and**] [**Wood board paneling**].

1. Latex over latex primer system.
2. Latex over alkyd primer system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light-industrial coating system.
6. Water-based alkyd system.
7. Alkyd system.

M. Architectural Woodwork: [**Wood paneling**] [**and**] [**casework**].

1. Latex over latex primer system.
2. Latex over alkyd primer system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light-industrial coating system.
6. Alkyd system.

N. Wood Traffic Surfaces: [**Floors**] [**and**] [**stairs**].

1. Latex porch and floor enamel system.
2. Alkyd floor enamel system.

O. Wood Shingles and Shakes:

1. Latex over latex primer system.
2. Latex over alkyd primer system.
3. Alkyd system.

P. Fiberglass Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Alkyd system.

Q. Plastic Substrates:

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. High-performance architectural latex system.
4. Water-based light-industrial coating system.
5. Alkyd system.

R. Spray-Textured Ceiling Substrates:

1. Latex, flat system.
2. Latex system.
3. Latex over alkyd sealer system.
4. Alkyd, flat system.
5. Alkyd over alkyd sealer system.

S. [**Gypsum Board**] [**and**] [**Plaster**] Substrates:

1. Latex over latex sealer system.
2. Latex over alkyd primer system (for plaster only).
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Water-based light-industrial coating system.
6. Alkyd over latex sealer system.

T. Acoustic Panels and Tiles:

1. Latex, flat system.
2. Latex over alkyd primer system.
3. Institutional low-odor/VOC latex system.
4. High-performance architectural latex system.
5. Alkyd, flat system.

U. [**Cotton or Canvas**] [**and**] [**ASJ**] Insulation-Covering Substrates: Including [**pipe and duct coverings**] <**Insert description**>.

1. Latex system.
2. Institutional low-odor/VOC latex system.
3. Alkyd system.
4. Aluminum paint system.

V. Bituminous-Coated Substrates:

1. Latex system.
2. Alkyd system.
3. Aluminum paint system.

END OF SECTION 099123

SECTION 102116.01 - HDPE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Solid plastic toilet compartments including the following: (Hiny Hiders)

1. Floor mounted overhead-braced toilet compartments.

1.2 RELATED SECTIONS

A. Section 05500 - Metal Fabrications: Structural support ceiling beam for ceiling hung partitions provided as Work of Section 05500; Unistrut channels not acceptable.

B. Section 06100 - Rough Carpentry: Anchorage/blocking for attachment of partitions.

1.3 REFERENCES

A. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Provide layout drawings and installation details with location and type of hardware required.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns.

F. Sustainable Design Submittals:

1. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
2. Regional Materials: Certify distance between manufacturer and Project and between manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A company regularly engaged in manufacture of products specified in this section, and whose products have been in satisfactory use under similar service conditions for not less than 5 years.

B. Installer Qualifications: A company regularly engaged in installation of products specified in this Section, with a minimum of 5 years experience.

C. Materials: Doors, panels and pilasters shall be constructed from High Density Polyethylene (HDPE) resins. Partitions shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking.

D. Performance Requirements:

1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with the ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:

a. Class B flame spread/smoke developed rating, tested to ASTM E84.

2. Material Fire Ratings:

a. National Fire Protection Association (NFPA) 286: Pass.
b. International Code Council (ICC): Class B.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.7 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 absolute limits.

1.8 WARRANTY

A. Manufacturer guarantees its plastic against breakage, corrosion, and delamination under normal conditions for 25 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge. (Labor not included in warranty.)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Scranton Products, which is located at: 801 E. Corey St. ; Scranton, PA 18507; Toll Free Tel: 800-445-5148; Email: request info (info@scrantonproducts.com); Web: www.scrantonproducts.com

1. Fabricator: Santana Toilet Partitions.
2. Fabricator: Comtec Toilet Partitions.
3. Fabricator: Capitol Toilet Partitions.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 MATERIAL

A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface;

1. Fire-resistance Rating: Class B.
2. Fire-resistance Rating: NFPA 286.
3. Recycled Content (Post Industrial): 25 %.
4. Recycled Content (Post Industrial): 100 %.

B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

C. Stainless Steel Castings: ASTM A167, Type 304.

D. Aluminum: ASTM 6463-T5 alloy.

2.3 SOLID PLASTIC TOILET COMPARTMENTS

A. Basis of Design: Hiny Hiders Toilet Partitions as manufactured by and supplied by Scranton Products.

1. Style: Floor mounted overhead-braced toilet compartments.

B. Doors, panels, and pilasters shall be 1 inch (25 mm) thick with all edges rounded to a radius. Doors and dividing panels shall be mounted based on height of specified system.

1. Door and Panel Height: 55 inches standard (1397 mm) (standard).
2. Door & Pilaster Edge: Standard.
3. Pilasters shall be 82 inches (2083 mm) high fastened to floor.

C. Panel Color:As scheduled on drawings.

1. Pilaster shoes shall be 3 inches (76 mm) high stainless steel (type 304, 20 gauge) secured to the pilaster with a stainless steel tamper resistant Torx head sex bolt.

D. Headrail shall be made of heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design. The headrail shall have a clear anodized finish and shall be fastened to the headrail bracket by a stainless steel tamper resistant Torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant Torx head screws.

1. Headrail brackets shall be 20 gauge stainless steel with a satin finish and secured to the wall with a stainless steel tamper resistant Torx head screws.

E. Wall Brackets:

1. Stainless Steel Brackets: Wall brackets shall be made of stainless steel type 304.
2. The brackets are fastened to the pilaster with stainless steel tamper resistant Torx head screws and fastened to the panels with stainless steel tamper resistant Torx head sex bolts.
3. Bracket Type: Continuous 54 inches (1372 mm) stainless steel.

F. Door Hardware:

1. Hinges: 54 inches (1372 mm) continuous stainless steel helix.
2. Vault Hinge: Heavy-duty diecast vault zamac hinge shall have gravity-acting cams and are fabricated from a die cast aluminum alloy with a brushed finish and wrap around flanges. The cam is constructed from ¾” diameter nylon rod and a 3/8” stainless steel pin.
3. Integral Hinges (Stealth): Hinges shall be integral, fabricated in the door and pilaster with no exterior exposed metal parts. Hinges operate with field adjustable nylon cams. Cams can be field adjusted to any degree.
4. Wrap-Around Hinges: Hinges shall be 8 inches (203 mm) and fabricated from heavy-duty extruded aluminum wrap-around hinges through-bolted to pilasters and doors with stainless steel tamper resistant Torx head sex bolts. Hinges operate with field adjustable nylon cams. Cams can be field set in 30, 60 or 90-degree increments.
5. Wrap-Around Hinges (Regal): Hinges shall be fabricated from heavy-duty cast aluminum, wrap around flanges through bolted to doors and pilasters. Hinges operate with field adjustable nylon cams. Cams can be field set in 30, 60 or 90-degree increments.

6. Door strike/keeper shall be made of heavy-duty extruded aluminum (6436-T5 alloy) with a bright dip anodized finish and secured to the pilasters with stainless steel tamper resistant Torx head sex bolts. Bumper shall be made of extruded black vinyl.

    a. Style: 54 inches (1372 mm) aluminum

7. Stainless Steel Slide Bolt Latch and housing shall be made of heavy-duty stainless steel type 304. The latch housing shall have a bright finish, and the slide bolt and button shall have a black anodized finish.
8. Provide occupancy indicator.
9. Each door shall be supplied with one coat hook/bumper and door pull made of chrome plated Zamak.
10. Equip outswing handicapped doors with second door pull and door stop.

2.4 SOLID PLASTIC PRIVACY SCREENS

A. Provide plastic privacy screens in urinal and entry toilet room applications as indicated or scheduled.

B. Panels, and pilasters, if required, shall be 1 inch (25 mm) thick with all edges rounded to a radius. Screens shall be mounted at 14 inches (356 mm) above the finished floor. Color as selected by Architect from manufacturer's full line of current colors.

1. Recycled content: Minimum 25 percent.

C. Type: Pilaster supported screen.

1. Configuration: Floor to ceiling pilaster supported screen.
2. Screen: Urinal screens shall be 18 inches (457 mm) wide by 42 inches (1067 mm) high.
3. Pilaster: Pilaster screens shall be 56 inches (1422 mm) high.
4. Headrail brackets shall be 20 gauge stainless steel with a satin finish and secured to the wall with a stainless steel tamper resistant Torx head screws.
5. Floor to Ceiling Supported Pilaster: A stainless steel angle shall be used to attach pilasters to floor and ceiling. These angles shall be attached to pilasters with 3/4 inch (19 mm) stainless steel tamper resistant Torx head screws. Pilaster sleeves shall be 4 inches (102 mm) high.

    a. Pilaster sleeves shall be stainless steel (type 304, 20 gauge) secured to the pilaster with a stainless steel tamper resistant Torx head sex bolt.

6. Pilaster sleeves shall be 3 inches (76 mm) high secured to the pilaster with a stainless steel tamper resistant Torx head sex bolt.

    a. Pilaster sleeves shall be stainless steel (type 304, 20 gauge) secured to the pilaster with a stainless steel tamper resistant Torx head sex bolt.

D. Wall brackets shall be made of extruded PVC plastic. Brackets are fastened to the panel/pilaster with stainless steel tamper resistant torx head screws and fastened to the wall with stainless steel tamper resistant torx head sex bolts.

1. Wall brackets shall be 54 inches (1327 mm) long.

a. Bracket Color: Mocha.
b. Bracket Color: Black.
c. Bracket Color: Grey.
d. Bracket Color: Linen.
e. Bracket Color: Beige.
f. Bracket Color: Blueberry.

E. Wall brackets shall be 1-1/2 inches (38 mm) stirrup type made of heavy-duty aluminum (6463-T5 alloy). Stirrup brackets shall be fastened to panel/pilaster with stainless steel tamper resistant Torx head sex bolts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that affect installation of partitions. Report discrepancies to the architect.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install partitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings.

C. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 3/8 inch (9.5 mm).

D. No evidence of cutting, drilling, and/or patching shall be visible on the finished work.

E. Finished surfaces shall be cleaned after installation and be left free of imperfections.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 102116.01

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Underlavatory guards.

B. Related Requirements:

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Public-use washroom accessories.
2. Underlavatory guards.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

C. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: Fifteen (15) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished, Contractor-Installed Materials:

1. Paper towel (roll) dispenser, surface mounted.
2. Soap dispenser, surface mounted.
3. Toilet tissue (roll) dispenser, surface mounted.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
2. Shower Seats: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Sanitary-Napkin Disposal Unit SND:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ASI-American Specialties, Inc.; 0458 Waste Receptacle, or comparable product by one of the following:

    a. Bobrick Washroom Equipment, Inc.
    b. Bradley Corporation.

2. Mounting: Surface mounted.
3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Grab Bar:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ASI-American Specialties, Inc.; 3800 Series Grab Bars, or comparable product by one of the following:

    a. Bobrick Washroom Equipment, Inc.
    b. Bradley Corporation.

2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).

4. OD: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

D. Mirror Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide ASI-American Specialties, Inc.; 0620 Series, or comparable product by one of the following:

    a. Bobrick Washroom Equipment, Inc.
    b. Bradley Corporation.

2. Frame: Stainless steel channel.

    a. Corners: Mitered and mechanically interlocked.

3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Buckaroos, Inc.
    b. Plumberex Specialty Products, Inc.
    c. Truebro; IPS Corporation.

2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch-minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

F. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 102800

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, single-roller shades.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 3 inches square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

F. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than One units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Clip, jamb mount.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Enclosed in sealed pocket of shadeband material.
b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches.

2. Endcap Covers: To cover exposed endcaps.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: PVC-coated fiberglass.
3. Color:As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations: At NEW exterior windows.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 126600 - GYMNASIUM BLEACHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work:

1. Telescoping gymnasium bleachers.

B. Related Work:

1. Electrical
2. Gymnasium flooring

C. References:

1. Applicable building codes to include IBC Edition Year 2018

1.2 DESCRIPTION OF THE SYSTEM

A. The bleacher system shall be comprised of multiple tiered, closed deck seating rows operating in a telescopic manner, incorporating the most economical quantity of sections while still complying with all loading requirements.

B. The first moving row shall be secured with friction or mechanical locks. Other rows shall be mechanically locked, operable only upon unlocking and cycling the first row, quantity to be determined by Interkal engineering.

C. Each bleacher row shall be comprised of risers, seat and deck components, and a complete set of supportive columns and braces.

D. The telescopic bleacher shall incorporate a locking system permitting the use of one, several, or all rows, each locked in the extended position.

1.3 QUALITY ASSURANCE

A. Manufacturing: Manufacturer shall be regularly engaged in the design and manufacturing of telescopic seating for not less than twenty years.

B. Engineering: It will be mandatory that each bidder submit with their bid an affidavit signed by a Registered Professional Engineer stating that the product to be supplied has been tested by an independent testing facility and meets all applicable code requirements.

C. Warranty:

1. 10-Year warranty on structural components of the understructure.
2. 5-Year warranty on all non-structural materials such as accessories, everything at deck level and above, and all power/electrical components.

D. Submittals:

1. Submit manufacturer's installation instructions and descriptive literature in accordance with Section 01300.
2. Manufacturer's operating and maintenance manuals in accordance with Section 01700.

1.4 DESIGN CRITERIA

A. Telescopic bleacher design and fabrication shall conform to (specify applicable code by year and ADA requirements).

B. Steel components shall be cold-formed from appropriate width strip stock conforming to ASTM A570 - Grade C 30KSI, ASTM A653- Grade 33 and 50, ASTM A500 - Grade B 46 KSI as applicable.

C. Lumber components are kiln dried, finger jointed, edge glued southern pine of grade "B & B Finish" manufactured to the current SPIB glued-laminated standards for southern pine.

D. Plywood deck boards shall be fabricated from Douglas Fir Premium Underlayment with exterior glue, 5 ply minimum, solid crossband directly under face ply, species Group 1 and manufactured in accordance with PS-1-95.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of- Design Telescopic seating as manufactured by Interkal, Kalamazoo, Michigan and represented by GOAT Athletix Tomball, TX 832-843-4331 or equal, subject to prior approval and strict compliance with these specifications.

2.2 MATERIALS

A. Model: Interkal, closed deck telescopic bleachers

B. Type: Wall attached

C. Quantity:

1. Provide the quantity of banks of wall attached telescoping bleachers in the number of rows and spacing as shown on plans.

D. ADA

1. Notchouts: Provide a 36” wide wheel chair space as shown on the plans and as required to meet local code jurisdiction compliance with ADA. (Specify one row or two row deep).

E. Dimensions:

1. Rise per row - 11-1/2”
2. Row to row spacing - 24” or 28” as shown on plans

2.3 PROPULSION

A. Friction Power- Furnish Interkal friction power, integral automatic electro-mechanical propulsion system to open and close telescopic seating system. Operation shall assure full visual control of the seating bank. The Wide Track System incorporates two friction drive roller assemblies as an integral part of both first row vertical column assemblies. Each section of bleacher shall have a power system that shall consist of two vertical column roller assemblies which shall include two 6” diameter by 2 ½” wide cast drive wheels for a minimum of four friction roller contact points per section of bleacher. Each roller shall have a specially formulated 45-durometer rubber covering to grip the floor as the units roll in and out. The two friction drive roller assemblies shall be installed a minimum of 7-feet apart per section. The two friction roller assemblies are linked together by a continuous drive shaft driven by a 1/2 H.P. 208V, 3-phase motor that shall enable the rollers to work simultaneously, resulting in a more efficient operation with allowance for minor variations in the floor surface. All floor friction power systems shall be controlled by a dual directional, removable walk along pendant which plugs into the front of the first row to give the operator proper position for visual control. The pendant control voltage shall be 24 VAC @ less than 50 MA for the safety of all operating personnel. The entire power system shall be U.L. Recognized. A 208/220 volt 3-phase power source, including conduit, wiring, and safety disconnect must be provided by others. The electrical contractor shall perform the connections to the seating equipment at the safety disconnect. Motors, housing, and wiring shall be installed by certified personnel.

2.4 ACCESSORIES

A. Foot Level Aisles: Provide footrest level aisles at locations and sizes as shown on plans and approved shop drawings.

1. Center Aisle: Provide a permanently attached self-storing aisle rail, which is designed to eliminate all labor associated with set up and storage of the aisle rails.
2. Intermediate Steps: Provide manufacturers standard intermediate step as necessary per applicable code.

B. Last Row Closure

1. Rear Closure Board: Provide and install a properly supported, flush mounted board between the last row of the bleacher and the wall.

C. Wheelchair Seating:

1. Notchouts: Provide manufacturers standard permanent handicap notchout (36” wide) located as shown on architectural plans. Notchouts must be located at section joints only to avoid interference with understructure. Fascia panels shall have manufacturers standard polydeck finish to match deck board surface. See plans for row depth.

D. Front Railing (if required): Provide rigid 36” high, fixed tubular steel rail with vertical intermediate members to fill design criteria. Rail to be mounted full width at all two row deep ADA wheelchair accommodations. Finish shall be a polyester powder coat. Front rails are to be designed to comply with all applicable codes and remain consistent with all other rails not allow clearance of a 4” sphere.

E. End Railing:

1. Self-Storing End Rails: Provide steel self-storing 42” high self-storing end guard rails with tubular supports and vertical intermediate members to comply with all code requirements. Rails shall be fitted to each exposed bank end from third row and above with all steel to steel connections. Finish shall be a polyester powder coat.

F. Operation

1. Pendant Control: Provide pendant control style operation for the bleachers. Extension and retraction shall be accomplished by use of the pendant control plugged into a single receptacle.
2. The receptacle shall be mounted at the first row.

G. Numbering: Provide seat numbers and row letters for sculpture seat modules. Sequence to be determined by architect or owner.

2.5 FABRICATION

A. Continuous Wheel Channel: Wheel channels shall consist of a one piece formed steel channel welded to the base of a vertical column. Wheel channels accommodate 8 to 12 wheels for maximum weight distribution and operating ease. The number of wheels increase as the number of rows increase.

B. Wheels: 3-1/2” diameter with 1-1/8” non-marring soft rubber face with rounded edges designed to protect wood or synthetic floor. Provide I/2” diameter axle for all wheels

C. Columns: Electrically welded closed rectangular steel tube, 2” x 3” minimum size, 14-gauge steel fitted with a rear welded gusset at the wheel channel.

D. Row Interlocks: Join each row structure front to rear by means of two (2) interacting steel connections, plus automatic gravity row locks where Engineering determines they are required.

1. Lower: Lower track guides shall be an external superslide rod to guarantee positive engagement of vertical supports without binding and assures smooth operation over uneven floor conditions.
2. Upper: Upper track guides shall completely interlock adjacent understructure support. A welded stop to ensure correct extension of bleacher unit on deck support. Use of bolt and nut stops are not acceptable, due to risk of loosening.

E. Diagonal Braces: Structural formed steel truss fitted to rows 4 and beyond. Bracing shall be attached to the rear riser at optimum locations to insure structural integrity. Bracing will be designed and shaped to support a minimum load of 1000(lbs) of both compression and tension forces created when the bleacher is loaded.

F. Deck Supports: Shall be of structural steel, 11 gauge spaced not greater than 60” on center for maximum deck stiffness.

1. Rollers: Every deck support not attached to a vertical post will have an integral nylon roller to avoid steel to steel friction points for more efficient operation.
2. Decking: All deck boards shall consist of 19/32” nominal C-C plugged Group 1 plywood with exterior glue and solid cross bands. Tongue and Groove deck boards are unacceptable. An extruded aluminum “H” connector shall be placed between plywood panels. Exposed wear surfaces shall be finished with a layer of high Density polyethylene plastic .025 - .030 thick, Light Gray in color, complimentary to the seat option. Deck finishes, such as clear coat, requiring more than simple touch up to restore it to a new appearance after wear occurs are unacceptable.

G. Welds: All welds shall be made at the factory by welders that are AWS certified on the equipment and process used.

H. Nose Beam: Shall be one-piece, grade 40, galvanized steel.

I. A minimum design thickness of .094” is utilized for the necessary structural integrity to accommodate section lengths up to 26’.

J. Rear Riser: Shall be one piece, grade 40, galvanized steel with a continuous access joint to fully encapsulate footrest panel for ease of cleaning and additional structural support. A minimum design thickness of .070” is utilized for the necessary structural integrity to accommodate section lengths up to 26’.

K. Splice Plates: (For Friction or Non-Friction power only) Each section joint shall be tied together with two structural steel members per row, employing a minimum of four steel to steel through bolt connections at the nose beam and a minimum of eight steel to steel through bolt connections at the lower steel rear riser. Splice plate material to match the nose beam and rear riser. Splice plates employing steel to plywood deck board attachments will not be acceptable. In order to minimize deflections and keep rows in alignment during operation, splice connections shall transfer both axial loads (tension/compression) and bending.

L. Fasteners: All structural connections shall be made with S.A.E. grade 5 or better stress rated bolts. The use of self-tapping bolts is not acceptable.

M. Finish:

1. Steel Understructure abraded, cleaned and finished with russet brown water base acrylic paint. Steel risers and nose beams finished with corrosion resistant silver gray matte finish with galvanized alloy plating.

2.6 SEAT OPTIONS

A. Excel Seat Modules (ESM):10" in locations shown on plans 18-inch wide one-piece individual seating modules shall be constructed of solid injection molded, high density polyethylene.

1. Each module shall have three longitudinal and five transverse internal ribs to provide additional structural integrity and resistance to impact.
2. Each module shall have a full 3/8" interlock to the adjacent module around the perimeter to eliminate pinching hazards and assure proper alignment.
3. Each module shall be equipped with an 11-gauge steel bracket for a steel-to-steel attachment of each module to the galvanized steel nose beam for maximum rigidity. All such mounting hardware shall be concealed.
4. End caps shall be provided at the ends of each bank (section, if manual) of seating as well as at each aisle.
5. Each module shall have a 2 ¼" x 1" recessed area for optional seat numbering.
6. Each end cap shall have two recessed areas including a 3 ½" x 3 ½" area for custom logos and a 2 ¼" x 1" area for row letters/numbers.
7. Select from manufacturer's 15 standard solid colors.

B. ComfoBack Automatic Contoured Backrest System: in locations shown on plans.

1. Fully Automatic Operation of backrest raising and lowering when bleacher is opened and closed.
2. Blow molded contoured back in 15 standard manufacturers solid colors.
3. Concealed spring mechanism to eliminate pinching hazard.
4. Black power-coated cast aluminum uprights.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Verify that areas to receive telescopic bleachers are free from impediments interfering with installation.

B. Do not begin work until building conditions are satisfactory.

3.2 INSTALLATION:

A. Install telescopic bleachers in accordance with manufacturer's instructions and approved submittal drawings.

B. Adjust bleachers for smooth and proper operation.

C. Clean bleachers and remove all debris from gymnasium resulting from installation.

END OF SECTION 126600

SECTION 126613 – TELESCOPIC SEATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Telescopic Gym Seating includes electrically operated multiple-tiered seating rows comprising of seat, deck components, understructure that permits closing without requiring dismantling, into a nested configuration for storing or for moving purposes.

1. Wall-attached telescoping stand.

1.2 REFERENCES

A. Aluminum Association (AA):

1. ADM 1- Aluminum Design Manual

B. American Institute of Steel Construction (AISC):

1. AISC 360- Steel Construction Manual.

C. American Iron & Steel Institute (AISI):

1. AISI S100 – Design of Cold Formed Steel Structural Members.

D. American Society for Testing Materials (ASTM):

1. ASTM - Standard Specifications for Properties of Materials.

E. American Wood Council (AWC):

1. ANSI/AWC NDS (National Design Specification for Wood Construction).

F. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code – Steel
2. AWS D1.3 Structural Welding Code - Sheet Steel

G. Canadian Welding Bureau: CWB Division 3 W47.1

H. U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

I. Forest Stewardship Council:

1. Chain of Custody Certification (FSC-STD-40-004)

J. International Building Code (IBC): 2021

K. International Code Council (ICC): 2017

1. ICC 300: Standard for Bleachers, Folding and Telescopic Seating and Grandstands.

L. National Fire Protection Association (NFPA):

1. NFPA 101
2. NFPA 5000**:** Building Construction and Safety Code
3. NFPA 70: National Electrical Code

M. National Institute of Standards and Technology (NIST)

1. PS 1: Structural Plywood.

N. Southern Pine Inspection Bureau (SPIB):

1. SPIB: Standard Grading Rules for Southern Pine.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer, fabricate and install telescopic gym seating systems to the following structural loads without exceeding allowable design working stresses of materials involved, including anchors and connections. Apply each load to produce maximum stress in each respective component of each telescoping stand unit according to ICC 300 2017.

B. Manufacturer's System Design Criteria:

1. Gymnasium seat assembly: Design to support and resist, in addition to its own weight, the following forces:

a. Live load of 120 lbs. per linear foot on seats and decking
b. Uniformly distributed live load of not less than 100 psf of gross horizontal projection.
c. Parallel sway load of 24 lbs. per linear foot of row combined with (b.) above
d. Perpendicular sway load of 10 lbs. per linear foot of row combined with uniformly distributed live load above.
e. Parallel and Perpendicular sway loads are not applied concurrently.

2. Hand Railings, Posts and Supports: Engineered to withstand the following forces applied separately:

a. Concentrated load of 200 lbs. applied at any point and in any direction.
b. Uniform load of 50 lbs. per foot applied in any direction.

3. Guard Railings, Post and Supports: Engineered to withstand the following forces applied separately:

    a. Concentrated load of 200 lbs. applied at any point and in any direction along top rail.
    b. Uniform load of 50 lbs. per foot applied in any direction at top rail
    c. Uniform load of 50 lbs. applied on an area equal to 1 ft^2 (0.09 m^2) applied on all guardrail infill panels.

1.4 ACTION SUBMITTALS

A. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations.

B. Provide Current Welding Certification[s] AWS or CSA.

C. Provide Manufacturers Certification of Insurance coverage of not less than $5,000,000 and Errors and Omission Insurance of not less than $2,000,000

D. Provide Installer Name, Current Certification Number and Product Qualifications

E. Provide Manufacturers' standard warranty documents.

F. Shop Drawings: For telescoping stands in both stacked and extended positions. Show seat heights, row spacing and rise, aisle widths and locations, assembly dimensions, anchorage to supporting structure, material types and finishes.

1. Electrical: Indicate power supply requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For telescopic bleacher to include video operations manual.

1.6 QUALITY ASSURANCE

A. Manufacturer shall be a current Certified Welding Fabricator as defined by either AWS or CWB, or both. The manufacturer shall comply with structural welding codes that are applicable to their products or materials. These welding codes shall be produced by AWS or CSA

B. Product to be supplied shall have a current evaluation report issued by ICC Evaluation Services (ICC-ES) certifying that it meets all structural design requirements of the current ICC 300 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, including all specified load combinations.

C. Electrical components, devices, and Accessories shall be listed and labeled as defined in NFPA 70, by a qualified testing agency and marked for intended location and application.

D. Installer Qualifications: Factory trained and certified by the manufacturer.

E. Seating Layout: Provide telescoping stands to comply with ICC 300 2017 Standard for Bleachers, Folding and Telescopic Seating, and Grandstands, except where additional requirements are indicated or imposed by authorities having jurisdiction.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver telescoping stands in manufacturers packaging clearly labeled with manufacturer name and content.

B. Handle bleacher equipment in a manner to prevent damage.

C. Deliver the telescoping stands at a scheduled time for installation that will not interfere with other trades operating in the building when at all possible.

1.8 PROJECT CONDITIONS

A. Field Measurements: Coordinate actual dimensions of construction affecting telescoping stands installation by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delay of Work.

1.9 WARRANTY

A. Manufacturer's Warranty: Includes the repair or replacement of the defective product; or defective component thereof, with a comparable product; or component thereof, or a refund of the purchase price prorated over the warranty period.

1. Includes: Labor, materials, and freight for replacement or repairs.
2. Structural Component parts of Understructure Warranty Period: Ten (10) years from Date of Acceptance.
3. Decking systems, seating collections, electrical, portable and integral dolly systems, end closure curtains, surface material finishes Warranty Period five (5) years from Date of Acceptance.

PART 2 - PRODUCTS

2.1 PRODUCT TYPES

A. Wood:

1. Lumber: NIST PS 20, southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B&B Finish (B and better) grade-of-finish requirements.
2. Plywood: NIST PS 1, APA-grade trademarked, A-C grade.

B. Steel:

1. Structural-Steel Shapes, Plates, and Bars: ASTM A36.
2. Galvanized-Steel Sheet: ASTM A653, Grade 40 (276 MPa) coating designation G60.
3. Uncoated Steel Strip; Non-Structural Components: ASTM A1011, Commercial Quality, Type B, Hot-Rolled Strip.
4. Uncoated Steel Strip; Structural Components: ASTM A1011 Grade 33 (228 MPa), Grade 36 (249 MPa), Grade 40 (276 MPa), Grade 45 (311 MPa), or Grade 50 (345 MPa), Structural Quality, Hot-Rolled.
5. Galvanized Steel Strip: ASTM A653 Grade 40 (276 MPa) or Grade 64 (441 MPa), structural quality, coating designation G60.
6. Tubing: ASTM A500, cold formed; Grade B, or ASTM A513, 46 ksi min yield.

C. Polyethylene Plastic: High-density polyethylene; injection molded, color-pigmented, textured, impact-resistant, and dimensionally stable.

2.2 MANUFACTURERS

A. Manufacturer: Basis of design is the Maxam Plus and Maxam products manufactured by the Hussey Seating Company, U.S.A.

2.3 TELESCOPING STANDS

A. Wall-Attached Telescoping Stands: Forward-folding system with the rear of the understructure permanently attached to the floor and to the rear wall. Rear wall provides structural support and must support loads imposed by the bleacher.

2.4 DIMENSIONAL AND OPERATIONAL CRITERIA

A. Dimensions:

1. Bank Length: As noted on drawings.
2. Aisle Width: As noted on drawings.
3. Number of Tiers: As noted on drawings.
4. Row Spacing: As noted on drawings.
5. Row Rise: As noted on drawings.
6. Net Capacity: As noted on drawings.

B. Operation: Integral Power

1. Integral Power: Pendant control unit.

2.5 SEATING

A. Polymer Seat System: Courtside Collection XC10.

1. Material: Gas assist injection-molded, 100 percent recyclable HDPE, high density polyethylene.
2. Module Size: 18 inches long by 10 inches.
3. Seat Height: 18-1/4 inches.
4. Integrally molded end caps at aisle end locations.
5. Integrally molded recess pockets to accept seat number and row letters.
6. Integrally molded rear closure panel at back of seat to allow for "continuous clean sweep" of debris at deck level and minimized visibility of structural ribbing.

B. Color: As selected by Architect from manufacturers 15 standard colors.

2.6 RAILS, PANELS AND STEPS

A. End Rails:

1. Self-storing

a. Provide steel self-storing rails starting no higher than tier two; 42 inches high above seat, end rail with tubular supports and intermediate members designed with 4 inch sphere passage requirements.

2. Material and Finish: Semi-gloss powder coated steel.
3. Color: Black

B. Center Aisle Rails:

a. Provide single pedestal mount handrails 34 inches high with terminating mid rail. Permanently attached handrail shall rotate in a permanently mounted socket for rail storage. Rail shall automatically rotate, lock in the use position, unlock and rotate back to the stowed position as the gym seats open and close. Ends of the handrail shall return to the post, and not extend away from it. Rails having openings to avoid interference with closed decks are not acceptable

2. Material and Finish: Semi-gloss powder coated steel.
3. Color: Black.

C. Skirt Panel: On 1st Row, provide galvanized steel front skirt panel to prevent players/objects from sliding underneath the first row.

D. Steps

1. Sure-Step (Flip-up Front Aisle Step): Permanently hinged to the front row to ensure availability and ease of operation. Two 3” diameter x ¾” wide non-marking front wheels are provided so that the system can be operated with the Sure-Step in the stored or deployed

position. All edges coined, hemmed or radiused with front edge protective rubber bumpers. Abrasive-backed non-slip tread identifier on leading edge of nosing.

2.7 COMPONENTS

A. Decking

1. Plywood

a. 5/8 inch thick AC grade tongue and groove Southern Yellow Pine with clear urethane, high gloss finish.

B. Understructure:

1. Finish: Rust-inhibiting black finish.
2. Hardware finish: Zinc-plated, Rust inhibiting black finish.
3. Posi-locks and other surfaces: Powder coated black, Rust inhibiting black finish.
4. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40 (276 MPa). Riser beam shall be continuously roll-formed of ASTM A653 Grade 64 (441 MPa). Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly. Nose beam and riser beams are through-bolted fore/aft to deck stabilizers and frame cantilevers to create the deck structure.
5. Frame: The frames are welded assemblies (one left hand, one right hand per tier) comprised of the following components:

a. Lower Track subassembly: ASTM A1011 Grade 50: Continuous Positive Interglide System (caster horn) interlocks each adjacent frame caster horn using an integral, continuous, anti-drift feature and captive interlock with adjustable row spacing at front to prevent separation and misalignment.
b. Lower Track Wheels: 3 per frame Not less than 5 inches diameter by 1-1/4 inches with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8 inch diameter axles secured with E-type snap rings.

1) Option: up to 6 wheels per frame for load distribution

c. Slant Columns: A500 Grade B, tubular shape.
d. Cantilever Subassembly: Consists of ASTM A1011 Grade 50 nose connection plate, cantilever, and riser attachment plate welded together into a subassembly.

6. Lock system: Caster horns at the end sections of powered banks contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
7. Sway Bracing: ASTM A653 grade 40 (276 MPa), tension members bolted to columns.
8. Deck Stabilizer: A1011 Grade 45, member through-bolted to nose and riser at three locations per section. Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment.

C. Fasteners: Vibration proof, in manufacturer's standard size and material.

2.8 ELECTRICAL OPERATION SYSTEMS

A. Integral Power

1. Default operation shall be with a removable pendant control unit which plugs into seating bank for tethered operator management of stop, start, forward, and reverse control of the power operation.

B. Furnish and install powered frames, an integral automatic electromechanical powered frame propulsion system, to open and close telescopic seating.

1. Electrical - Seating Manufacturer shall provide all wiring within seating bank, including pendant control. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code. The control system shall operate at low voltage (24V). The electrical contractor shall perform all connections at and upstream of the equipment specified herein and ensure that supplied voltage drops no more than 4% below nominal where power connects thereto.

2. Each unit for PF(3) is driven by a 1/2 horsepower, 1725 RPM motor.

a. 208V 3 Phase:

1) This 1.25 Service Factor motor runs on 208V at 60 Hz and draws a full load current of 1.8 amperes. The required power supply shall be 3 asynchronous phases of 120 Volts each, plus neutral plus ground, each with 20 Amp capacity.
2) This system shall be UL Listed in its entirety (motors, circuit protection, motor controls, user interface, enclosures, conductors and connectors all evaluated and approved for correct sizing and compatibility under maximum rated load on the motors) under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating.

b. Each pair of Powered Frames shall consist of output shaft gear reducer with 6 inch diameter x 4 inch) wide wheels covered with non-marring 1/2 inch thick composite rubber, and operate the bleacher as follows:

3. Annual Service Light

a. The annual service light unit is a low voltage (24V) system that is integrated into the electrical control system on a powered bleacher.

1) This system shall be UL Listed under UL Product Category FHJU, titled Electrical Drive and Controls for Folding and Telescopic Seating (UL File No. E467277).

b. This unit serves two main functions:

1) Keep a continuous timer running that will indicate to the end user that an annual inspection of the bleacher is required.
2) The unit will retain the counting data for no less than 6 months without power.
3) There will be a light illuminated at the front of the bleacher once the counter reaches one calendar year.
4) The counter and light can be reset by authorized personnel once an inspection has been completed.
5) Record the forward, reverse, and total operating time of bleacher.
6) This data can be viewed at any time from inside of the unit.

4. Manufacturer shall furnish parts and instructions for installing an annual service light unit on the primary seating bank.

2.9 FABRICATION

A. Fabricate understructure from structural-steel members in size, spacing, and form required to support design loads specified in referenced safety standard.

B. Weld understructure to comply with applicable AWS standards.

C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

A. On completion of installation, test and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.

B. Clean installed telescoping stands on exposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain telescoping stands.

END OF SECTION 126613

SECTION 20 00 00 - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work of Division 20-24 consists of providing labor, materials, products, and all operations required for the complete operating installation of ALL systems as shown and specified, in strict compliance with applicable drawings, specification, terms and conditions of the contract and all applicable codes and ordinances governing the installation of the various mechanical systems. Contractor shall provide all equipment and materials necessary and usually furnished in connection with such work and systems whether or not specifically mentioned in the specifications or on the drawings. All work is to meet individual product manufacturers written installation instructions. All work shall be fully correlated with the work of other crafts. This section of Division 20-24 is a part of all other sections of Division 20-24.

B. Each Contractor shall study the Contract Documents included under this contract to determine exactly the extent of work provided under this contract, as well as to ascertain the difficulty to be encountered in performing the work on the drawings and outline hereinafter and in making new connections to existing utilities, installing new equipment and systems and coordinating the work with the other Trades.

C. Notwithstanding any approvals or instructions which must be obtained by the Contractor from the Architect in connection with use of premises, the responsibility for the safe working conditions at the site shall remain that of the Contractor's, and the Architect or Owner shall not be deemed to have any responsibility or liability in connection therewith.

D. The Agreement Forms, Uniform General Conditions, Supplementary Conditions, Division 00 and Division 01 of the specifications shall apply to the work specified in Division 20-24.

E. Additional Site Visit Costs: Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.

F. The Contractor shall obtain and pay for all permits and fees associated with his work.

G. REMODEL WORK: COORDINATE ALL CONNECTIONS OF NEW EQUIPMENT WITH EXISTING SERVICE. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT, MATERIALS, AND INCIDENTAL ITEMS REQUIRED TO MAKE SYSTEM COMPLETE AND OPERABLE. CONTRACTOR TO DO ALL RREQUIRED DEMOLITION TO ALLOW FOR INSTALLATION OF NEW WHETHER SHOWN OR NOT. FIELD VERIFY ALL EXISTING CONDITIONS.

1. MEP Demolition: Contractor is to demolish, remove, and make safe any MEP component required to provide the final installation documented on the Plans and Called for the specifications.

H. **NO TOXIC OR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD, SHALL BE PROVIDED OR INSTALLED. ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

I. **An pdf copy of all Field Reports shall be kept in a separate notebook or pdf set up in the Construction Manager's Trailer. Contractors shall use these reports to check off that each individual item noted has been completed. Each item shall be initialed and noted when completed. Use this notebook to keep record of all test and results (i.e. wastewater test, water line tests, etc.**

J. **Drawings:**

1. **Architectural Background Files** – Architectural Revit Models and CAD files to be used for background files, MEP drawings are not background files. Architectural Revit Models and CAD files are used for shop drawings backgrounds. They must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

2. **MEP Drawings** – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested, they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of $500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.

3. **MEP CAD Files that will be released.**

   a. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.

   b. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.

   c. Fire Alarm/Fire Sprinkler/Intercom etc.… Contractors must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this portion of specifications will be cut and pasted into an email for you to read.

4. Reference **"HCE BIM Protocols"** – document attached to the end of this section. It defines the expectations, limits and level of development of any 3D design tool, (if used) for any portion of a project design, to develop 2D bid documents. This applies to 3D design tool used by design teams as well as 3D design tool that may be requested by Contractor.

K. **Site observation communication between Engineer and Contractors will be using online software. Contractors required to carry license for duration of project. Reference 3.09.**

1.02 MANDATORY PRE-CONSTRUCTION MEETING

A. **DDC Contractor, Mechanical Contractor, Test and Balance Representative and representatives for each type of HVAC gear that requires interface beyond 'on/off' control will meet in the office of HCE or Online meeting (at discretion of Engineer) prior to initial control submittal. (if this meeting does not happen General Contractor to hold $25,000 from payapp of each applicable subcontractor until it happens.)**

B. **The purpose of this meeting is to introduce all representatives who will need to coordinate with each other to insure a working project.**

C. **Each representative is to come prepared with sequences of operation, schematics and written instructions as to which points require what type of signal for each function and how tie-ins and integrations are to occur. If pulsed signals are required to keep a device on, bring it to the attention of the team and provide specific information. Do not assume others understand the inner workings of your gear or controls. Discuss exactly what type signals are acceptable to gear and how to set it up to receive and act on that signal so equipment and controls can be fully integrated by the contractor prior to final completion of the project.**

D. **Newer multistage air volume split systems, RTU's, etc. have different sequences and control tie-ins than older conventional units. Exact requirements for a given type and brand of equipment must be coordinated by the equipment supplier with the Controls Contractor and with the Test and Balance Contractor.**

E. **Test and Balance Contractor must verify air flow and delta T's across coils at every stage of unit capacity to insure that unit is providing the correct CFM based on the capacity stage it is on so that the unit does not end up with low stage cooling and high stage blower which will not dehumidify. Equipment supplier is to provide Test and Balance Contractor with a quick start up guide to show where and how to set up fan speed selections and outside air dampers so that only minor balancing occurs at dampers serving grilles**. Discharge Air in ALL Cooling stages should be 56 degrees or lower.

1.03 SITE INSPECTION

A. Prior to bidding the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.

B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative herewith or otherwise shall be complied with in every respect.

1. Electrical Specifications: Division 26-28.

2. Mechanical, Electrical, Plumbing Drawings

B. Unless otherwise indicated on the Electrical Drawings or in Mechanical Specifications, provide all mechanical equipment motors, motor starters, disconnect switches, thermal overload switches, control relays, time clocks, thermostats, motor valves, damper motors, electric switches, electric components, wiring, and any other miscellaneous Division 20-24 controls.

C. Carefully coordinate all work with the electrical work shown and specified elsewhere in these documents.

D. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than plus or minus 10 percent of rated voltage.

E. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.

F. Size motors for 1.15 service factor, not to exceed 40 degrees temp. Rise above ambient.

G. Provide self-resetting thermal overload switch for fractional horsepower motors.

H. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.

I. When Mechanical Contractor furnishes motor starter, provide each three-phase motor 25 HP and larger with phase failure and phase reversal monitoring relay in all three phases. Relay shall open motor starter contacts at 10% voltage unbalance and shall automatically reset when voltage returns to normal. Provide adjustable time delay set at .2 second on drop-out to prevent nuisance tripping on momentary voltage dips.

J. Duct smoke detectors are to be provided in supply and return by Mechanical Contractor when there is no Fire Alarm Contractor. When Fire Alarm is present and Fire Alarm Contractor on job, Fire Alarm Contractor shall provide detectors, installed by Mechanical Contractor, tied into HVAC control circuit by Mechanical Contractor and to fire alarm panel by Fire Alarm Contractor.

K. Duct smoke detector in supply and return air provided and installed by Mechanical Contractor for units over 2000 cfm and/or units serving rated egress pathways or as scheduled. Provide detectors with remote test switches and audible/visual indicators. Locate them beside unit thermostat unless otherwise noted.

L. **The electrical design and electrical drawings are based on the equipment and/or electric motors of the type, size and electrical characteristics shown and specified on the mechanical drawings and any change in equipment and/or motor size or type brought on directly or indirectly by a substitution of mechanical equipment having characteristics requiring a change, shall be the responsibility of the Mechanical**

Contractor and the entire cost of such change, including conduit, wiring, motor starting equipment, etc., shall be paid for by the Mechanical Contractor at no additional charge, unless the substitution was initiated by the Owner. Submittals must clearly show any deviations. Mechanical Contractor is responsible for coordinating any required changes with the Electrical Contractor, prior to Electrical Contractors ordering of panels and associated equipment.

M. **Mechanical contractor assumes requirements of Controls Contractor when there is no separate Controls Sub-Contractor.**

N. **High Wind Zones: Contractor shall be responsible for delegated design to secure ALL equipment/assemblies, ground or roof, so that they are secured/restrained per code for High Wind/Hurricane zones per the latest code maps.**

1.05 WORK NOT INCLUDED

A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source, and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.

1.06 SPECIFICATION TERMINOLOGY (Definitions)

A. Streamlining: In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.

B. "Furnish" means to purchase and deliver material as shown and specified, including mark-ups, and cart the material to an approved location at the site or elsewhere, as noted or agreed.

C. "Provide/Install", as used in these specifications, means furnish all material, labor, sub-contracts, and appurtenances, including mark-up required for a complete, operating, finished system.

D. "Rough-in and Connect Only" means provide an appropriate system connection, such as supplies with stops, continuous wastes with traps, shut-off valves required, and all piping connections, testing, etc., for proper operation, and to install equipment furnished. Equipment furnished is received, uncrated, assembled and set in place by supporting crafts unless they make prior arrangements to hire the mechanical installer for this work.

E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. It shall also be no more than four feet (4') above a ceiling.

F. "Serviceable" means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction, or damage to the surrounding installation.

G. "Product" is a generic term which includes materials, equipment, fixtures, and any physical item used on the project.

H. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

I. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit. "Piping" includes, in addition to piping, all fittings, valves, hangers and other accessories relative to such piping.

J. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, crawl spaces, etc.

1.07 DIAGRAMMATIC DRAWINGS

A. Drawings and specifications encompass a system that will integrate with the structural, electrical, plumbing, mechanical, civil, technology, architectural design and all design sub-consultants of the building. Reference ALL disciplines sets of drawings for complete scope of work.

1. Drawings and specifications are complementary, each to the other; what is shown on one is as binding as if called for in both.

2. Where drawing details, plans, and/or specification requirements are in conflict, and where conduit, duct and piping sizes of the same run are shown to be different between plans and specifications or details, the most stringent requirement will be included in the Contract. Systems and equipment called for in the specification and/or shown on the drawings shall be provided under the contract of each Trade as if it were required by both the drawings and the specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to the Architect's attention for direction as to what is to be provided.

B. The drawings are partly diagrammatic in character and do not show exact locations, all offsets, or give exact elevation in piping, fittings, duct, conduits, etc. Also, the drawings do not necessarily show in minute detail all features of the installation. Contractor is to install all products coming with manufacturer’s written instructions and installation details per the manufacturer’s instructions, unless specifically instructed to deviate by project engineer. Contact engineer for direction if conflicts occur for direction. Contractor shall physically arrange the systems to fit in the space available and shall carefully investigate structural and finish conditions, arrange work accordingly and provide a complete and satisfactorily working installation. Provide all work shown on the drawings and specified, unless otherwise stated. No subsequent allowance will be made due to failure to coordinate work prior to installation.

C. Plumbing Piping and Fixtures – Plumbing Pipes are partially diagrammatic in nature. Plumbing mains and distribution pipes are shown and sized, individual taps for fixtures are to be provided at every location a fixture is shown on plumbing and architectural sheets. Even if not specifically drawn it is implied that EVERY plumbing fixture have the connections called out on ‘Pipe Sizing Requirements’ and ‘Fixture Connection Schedule’ and as required from manufactures installation instructions. Hot water tap and shutoff valve above ceiling, cold water tap and shutoff valve above ceiling, waste connection, vent connection, etc. Gang restrooms shall have shut off valve in hallway for the following pipes feeding chase, cold water feed, hot water feed and balancing valve on the hot water recirculation line leaving the chase. All fixtures require shut-off valves for individual fixtures except as called out for gang restrooms with chase feed.

D. The Architectural, Structural, Civil and Electrical plans and Specifications and other pertinent documents issued by the Architect are a part of these Specifications and the accompanying Mechanical Drawings and shall be complied and coordinated with in every respect. All drawings and specifications mentioned above shall be examined by all bidders. Failure to examine all drawings for coordination and quantities shall not relieve the Contractor of responsibility and no subsequent allowance for time or money will be allowed.

1.08 MATERIAL AND EQUIPMENT SUBMITTALS

A. Submittals: Provide submittals for all products and systems described in Division 20-24 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.

B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) cover will be returned and required to be broken into separate submittals.** The Engineer's check will be general and does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.

C. Submittal Review Time – In order to provide the most efficient submittal review and to cut down delays of equipment with long lead times, the Engineer requests the Contractor Provide a Submittal Schedule at the beginning of the job within 20 days of contract award. At the beginning of the project the contractor is to review job schedule and material lead times. Based on that information the Contractor shall put together a reasonable schedule of dates that each submittal is needed to be returned in order of importance, to order materials. ALL submittals, with separate covers and identifiers shall be submitted to the design team as early in the projects as possible. The design team can NOT practically review ALL submittals at once in 2 weeks, but the design team can schedule review time for all submittals in priority order, based on the Contractor provided Submittal Schedule, to be returned to contractor prior to the requested schedule date from the contractor. Submittals that are haphazardly submitted late in the project cycle creating artificial time emergencies are not the responsibility of the Engineer to provide unreasonable expedited review. Complicated submittals require extended review time, and this should be taken into account. Submittal review time requested only applies to standard workdays, and excludes weekends and holidays. Extended company holidays are typical at Thanksgiving Wednesday-Friday and the final 2 weeks of the year at Christmas and New Year, our office is closed. These times frames should be considered while producing the required Submittal Schedule.

D. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**

E. **Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.**

F. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section. Separate PDFs for each Submittal number.**

G. **HARDCOPY SUBMITTAL REQUIREMENT: Hardcopy submittals will not be required by Engineer.**

H. **PDF SUBMITTAL REQUIREMENT:**

1. For submittal sections listed below as allowed pdf's the following requirements must be met, or the submittal will not get through email security and will be auto deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected**.

2. **PDF FILE:** MUST BE NAMED AS FOLLOWS:

   JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

3. **EMAIL TITLE/SUBJECT**: FOR SUBMITTALS MUST BE AS FOLLOWS:

   JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

4. Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays caused by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

I. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc. will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**

J. **SUBMITTALS WILL BE RETURNED IN ORDER OF CONSTRUCTION OF THE PROJECT, NOT NECESSARILY IN ORDER SUBMITTED**. If all sections are submitted under one binder and transmittal, each section will be returned at the appropriate time for construction phasing. Mechanical Equipment will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Mechanical Equipment, Mechanical Controls and Plumbing Fixtures may require extended review time. **IF SUBMITTALS ARE SUBMITTED EARLY RELATIVE TO CONSTRUCTION PHASING, SUBMITTALS MAY BE HELD, REVIEWED AND RETURNED AT THE APPROPRIATE TIME FOR CONSTRUCTION PHASING, NOT NECESSARILY 2 WEEKS.**

K. **DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS. Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications, submittal will be required. Deviations must be noted on Transmittal and highlighted in submittal. (Write summary sheet of deviations and highlight items that are different to allow for proper review.):**

1. 20 01 00 – Basic Materials and Methods – Only items listed

- Valve Tag / Markers
- Pipe Identification / Labels
- Fire Proofing/Fire Caulk
- Access Panels / Doors
- Valves

L. **PDF Submittals** for the following items:

Separate PDF for each Submittal number is required.

1. 20 00 00 – General Provisions
   - Roof Opening Shop Drawings
   - Mechanical/Electrical Coordination Sheet
   - Plumbing/Electrical Coordination Sheet
2. 20 01 00 – Basic Materials and Methods
   - All items not excluded above
3. 20 07 00 – Insulation
4. 21 00 00 – Fire Sprinkler Product Data
5. 22 11 16 – Water Distribution Systems
6. 22 13 16 – Liquid Waste Transfer
7. 22 30 00 - Plumbing Fixtures and Trim
8. 23 05 93 – Test and Balance Report
9. 23 30 00 – Air Distribution

M. **Data Required for Review: Mark submittal literature and shop drawings clearly by individual sections, and include all equipment and material shown on drawings and specified. ANY DATA NOT CLEARLY MARKED OR NOT APPROPRIATELY SUBMITTED WILL BE RETURNED WITHOUT CHECKING. Indicate the following:**

1. Specification reference and/or drawing reference for which literature is submitted for review with an index, following specification format, and item by item identification.
2. Manufacturer's name and address, and supplier's name, address, and phone number.
3. Catalog designation or model number.
4. Rough-in data and dimensions.
5. Performance curves and rated capacities with performance data marked.
6. Motor characteristics and wiring diagrams.

7. Operation characteristics.

8. Complete customized listing of equipment, characteristics, accessories, etc., specified. Indicate whether item is "As specified." Mark out all non-applicable items. The terminology "As specified" used without this customized listing is not acceptable.

9. Wiring diagrams for the specific system operation. Complete wiring with diagrams showing all connections to each type of actual equipment being installed on project, complete with part numbers of controls for each type of equipment.

10. **Equipment manufacturer/vendor must submit written sequence of operation for all modes of operation for each piece of mechanical equipment with the equipment submittal. Give narrative explaining exactly what control signals are required to activate <u>each</u> mode of a particular unit's operation. Include information about which signals override others internally (when applicable). Submit this information with equipment submittal and provide a copy to the Controls Contractor so it can be integrated into the control scheme and control submittals. Indicate whether 24 VAC, 4-20 MA, 0-10VDC or line voltage is required for controls.**

11. **Provide HVAC equipment with a controls interface that is suitable for connection to a standard conventional thermostat and/or non-proprietary DDC control systems unless it is SPECIFICALLY scheduled otherwise.**

12. **Ductwork Shop Drawings: Engineer requires PDF, full-size at 1/8" scale, sheets size to match project for engineer review and engineer records. Additional copies per Architect and Owner requirements. PDF's will be required for owner and architect records.**

13. **<u>BREAKOUT SUBMITTALS INTO PRIORITY ITEMS.</u>**

N. **Contractor to submit "Mechanical/Electrical Equipment Coordination Sheet" with equipment submittal for all electrified mechanical equipment, including but not limited to: MAU, RTU, VAV, FP, RTU-VAV, CHILLER, PUMP AHU, CU, HP, HRU, CC, ERV and HETD, etc... Reference chart at end of section.**

1. The Mechanical Contractor is to use the "Mech/Elect Coordination Sheet" found in Specification Section 20 00 00 to coordinate the electrical requirements of the mechanical equipment with the Electrical Contractor. This applies to all mechanical equipment, not just VRF equipment.

2. The Mechanical Contractor is to submit a copy of the completed Coordination Sheet that has been reviewed and signed by the Electrical Contractor.

3. Mechanical equipment submittal will be rejected and returned if submitted without a Coordination Sheet that has been signed by the Electrical Contractor. A copy of the Coordination Sheet should be attached to each separate mechanical equipment submittal.

4. The Mechanical Contractor is responsible for any cost associated with changes in electrical requirements if alternate equipment (equipment not scheduled on plans) is provided on this project. This includes equipment that may be listed as equal or as an approved alternate.

5. The Electrical Contractor is to verify that the scheduled electrical voltage and phase is available on site.

6. The Electrical Contractor is to provide the MOCP (maximum over current protection) listed on the Coordination Sheet. As well as wire size with ampacity equal to or greater than the listed MOCP.

7. An approved submittal does not release the contractors from coordinating the mechanical equipment and associated electrical service to provide the Owner with a complete and operable system.

O. When requested, present samples of all materials proposed for use to the Engineer for his approval.

P. Certify Shop Drawings have been checked for compliance with Contract Documents and coordinated with other trades. Certify that the materials submitted can be delivered and installed according to the construction schedule.

Q. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility and submit to the Engineer for approval.

R. **Substitutions:** ("Substitution Request" form must be submitted)

1. Equipment listed as equal is indicated to be equal in quality to equipment designed around. It does not mean equal in dimension or fit. It is the Contractor's responsibility to confirm dimensional differences and space requirements.

2. Request for proposed substitution of materials, methods, or processes shall be made to the Architect a minimum of ten (10) days prior to bid date and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.

3. When contractor is requesting a substitution prior to bid, request permission in writing from the Engineer still using "Substitution Request" form.

   a. In the request for substitution, state the amount of adjustment to be made in the contract price in order to give the Owner the benefit of any savings in materials or labor costs.

   b. All substitutions shall be of equal or better quality to the equipment specified.

4. Equal Materials: It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer, or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity, and other characteristics.

5. Acceptance of substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and of work on schedule.

6. Where equipment of the acceptable manufacturers requires different arrangement or connections from those shown, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor proposing substitutions shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under other Sections, including location of rough-in connections by other Trades, conduit supports, insulation, etc. All changes shall be made at no increase in the Contract amount or additional cost to the other Trades and/or Owner.

7. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution requests will be automatically rejected.**

8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**

   a. Mechanical Equipment

   b. Contractor Cost Savings Packages Requiring Substantial Review Time

1.09 SHOP DRAWINGS REQUIRED

A. **Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination. Provide shop drawings for all products, ductwork, systems, system components and special supports which are not standard catalog products, and which may be fabricated for the Contractor or by the Contractor. Show top and bottom elevation of ductwork and equipment as it will be installed. Show offsets required to miss structural and other items of interference. Identify all shop drawings as to which section and paragraph of the specifications and/or drawing number the item is covered under. Ductwork layout/shop drawings to be done at a minimum 1/8" = 1'-0" scale. AHU's, CU's, HP's, RTU's, etc. are to be shown actual scaled size and configuration of the actual equipment being used.**

B. **Plumbing Piping shop drawing required –**

   1. **Waste piping with starting inverts and inverts at civil connections. For coordination with structural slabs and beams and civil connections. Show approximate VTR locations and sizes for coordination with Mechanical Contractor outside air intake.**

2. **HW and CW piping mains and indicate any penetrations through slab for coordination with structural and civil contractors.**

3. **Electrical Panel Locations.**

4. **Cable tray locations**

5. **Above ceiling mechanical equipment, including 36" horizontal working clearance on access side.**

C. Architectural Revit Models and CAD files to be used for backgrounds in preparation of ductwork and sprinkler shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01,J.

D. ALL SHOP DRAWINGS OF MECHANICAL ROOMS/MEZZANINES SHALL SHOW ALL FLOOR DRAINS, HVAC, PLUMBING, AND ELECTRICAL EQUIPMENT, INCLUDING ELECTRIC PANELS, TRANSFORMERS AND DISCONNECT SWITCH LOCATIONS. COORDINATE WITH ELECTRICAL AND PLUMBING CONTRACTOR.

E. Provide roof shop drawing indicating dimensioned locations and sizes for all roof mounted equipment, supports, openings and plumbing vents in ample time for proper coordination of all trades.

F. Submission of copies of the Engineer's drawings does not constitute shop drawings and is not acceptable.

G. Submittal of complete engineering submittal data for products and equipment shall be made in. Provide an electronic copy in PDF format and CAD if available for record keeping purposes for Engineer, Architect, and Owner with close out documents described elsewhere in specifications.

H. **General Contractor shall transmit a CAD copy of ductwork shop drawings to sprinkler contractor prior to submission of sprinkler shop drawings.**

I. **General Contractor shall transmit a CAD copy of ductwork shop drawings to plumbing contractor prior to submission of piping shop drawings.**

J. Ductwork shop drawings shall be submitted and reviewed prior to any ductwork being installed. If shop drawings are not provided or fully coordinated with all trades, existing conditions or new conditions, the Mechanical Contractor and his subcontractors will not be compensated for any changes required to be made to allow for proper fit or routing of all systems, including systems provided by other trades. The Contract Documents are diagrammatic in nature and are intended to convey the overall design of the MEP systems and are not intended to be used as Shop Drawings. Duct Shop Drawings are to be provided by the Mechanical Contractor and should include all work that will be installed near mechanical work but performed by other trades, including but not limited to ductwork, mechanical, plumbing, and electrical equipment, all piping including fire sprinkler, condensate and refrigerant piping, structural members, architectural elements, cable etc. The Mechanical Contractor is responsible for looking at all Contract Documents by all disciplines as well as existing conditions for remodels or additions to existing building prior to bid. Any modifications that need to be made from what is shown on the Contract Documents is the responsibility of the Mechanical Contractor.

K. Plenum Return Air Path Shop Drawing Submittal:

1. Walls to deck without proper transfer openings pose serious restrictions to return air flow, this hampers HVAC performance. Every attempt is made to show transfer openings in penetrable walls (not rated stairway or science room, wall, etc.) known to go up to deck during design. In order to insure full return paths are maintained during construction the following coordination is required. Prior to wall construction the General Contractor and Mechanical Contractor are to mark up mechanical floor plan(s) highlighting in yellow where any wall will go to deck. Indicate a bulkhead or anything similar going to deck above ceiling level in blue highlighting. Indicate fire/smoke walls with orange highlighting and indicate transfer openings with green highlighting. Provide copy to Engineer a minimum of 3 weeks prior to gyp being installed on walls for instructions on where to add additional wall openings and size required for proper transfer of return air. When additional walls or things like bulkheads are run to deck additional transfer openings must be created. It is contractor's responsibility to insure that there is a sufficient air path around or through such obstacles. Any not caught during construction are to be added at no additional cost post construction as required. Passing an above ceiling inspection does not relieve this requirement. Ducted transfers are not required when a given wall does not actually go to deck, even when a transfer is shown. This work and coordination is to be included in bid and is to be done at no additional cost to Owner. Contact Engineer for guidance as needed.

L. **MECHANICAL CONTRACTOR MUST SUBMIT "MECHANICAL/ELECTRICAL COORDINATION SHEET" WITH MECHANICAL EQUIPMENT SUBMITTAL FOR PROPER COORDINATION PURPOSES WITH ELECTRICAL CONTRACTOR FOR ACTUAL EQUIPMENT BEING INSTALLED OR SUBMITTAL WILL BE REJECTED.**

M. **PLUMBING CONTRACTOR MUST SUBMIT "PLUMBING/ELECTRICAL COORDINATION SHEET" WITH PLUMBING EQUIPMENT SUBMITTAL FOR PROPER COORDINATION PURPOSES WITH ELECTRICAL CONTRACTOR FOR ACTUAL EQUIPMENT BEING INSTALLED OR SUBMITTAL WILL BE REJECTED.**

1.10 RECORD DRAWINGS

A. Reference requirements stated elsewhere in the Specifications. Where drawings are referenced, it is considered synonymous with pdf drawings or pdf prints.

B. THE CONTRACTOR SHALL TAPE ALL ADDENDA'S ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THE CONTRACTOR HAS COMPLIED WITH THIS REQUIREMENT.

C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the General's site trailer and marked up weekly as the work progresses, to show exact dimensioned location and routing of all mechanical work which will be permanently concealed. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Show the location of all valves and their appropriate tag identification. Indicate locations of all existing active and inactive piping uncovered during construction. **Keep marked up set at site for review at site meetings.**

D. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed for draw requests. They shall be inspected periodically by the Architect and Owner's Representatives, and they shall be corrected immediately if found either inaccurate or incomplete. **This procedure is mandatory.**

E. The Contractor shall be responsible for updating and/or marking all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job, marked up As-Built Drawings shall be submitted to the Architect for final review and comment. These corrected prints together with corrected prints indicating all the revisions, additions, and deletions of work, shall form the basis for preparing a set of record drawings.

F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints, one for submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contactor shall provide pdf copies/scans for owner record purposes.

G. The Contractor shall bear all the costs of producing the "Record Drawing Set".

H. All equipment's **model and serial numbers** must be included on start up forms turned in to the owner. For split systems, this includes all model and serial numbers for all indoor sections or components as well as outdoor units. These are required for owner inventory and for processing of any utility rebate forms. Utility rebates require the model and serial numbers associated with a given unit number to match, in case the job is spot checked prior to issuing a rebate.

1.11 CODES, REGULATIONS AND ORDINANCES

A. All work shall comply with the current applicable local, state, and federal codes and ordinances. Follow recommended practices as set down by ASME, SMACNA, ASHRAE, NFPA, applicable Building Code, applicable Mechanical Code, applicable Plumbing Code, National Electrical Code (NEC), AGA, ADA, AND OSHA, as they apply to this project, except in cases where local statutes govern. The contractor shall verify with the latest adopted local codes, ordinances and amendments that apply to this project with the authority having jurisdiction. **PROVIDE LOCKING REFRIGERATION ACCESS PORT CAPS FOR ALL EQUIPMENT WITH REFRIGERANT LOCATED OUTDOORS ON GROUND OR ON ROOF.**

B. In cases of difference between Building Codes, State Laws, Local Ordinances and Industry Standards and the Contract Documents, each Subcontractor shall promptly notify the Architect in writing of any such difference, as applicable to his work.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building codes, State laws, Local Ordinances, and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.

1.12 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

A. **All equipment and materials shall be protected from physical, moisture absorption, metallic corrosion, and weather damage from the time of delivery until completion of the project. This includes erection of temporary shelters and covering items in the**

building with protective covering. Store items subject to moisture damage such as insulated curbs in dry locations. Items such as controls in dry, heated space. Failure to comply with the above to the satisfaction of the Owner/Architect will be sufficient cause for the rejection of the equipment or material in question. Upon such rejection, the damaged equipment or material will be completely replaced with new by the Contractor at no charge to the Owner.

B. **Provide covers on all ends and openings of pipes, conduits, ducts, etc. to keep out insects, dirt, dust, and debris during entire construction process. This includes properly covering unassembled ductwork, etc. stored on jobsite prior to installation.**

C. The Manufacturer's directions are to be followed from delivery, storage, protection and installation of equipment and materials. Notify the Architect in writing of conflicts between requirements of Contract Documents and manufacturer's direction.

D. Large pieces of equipment which are too large to permit access through doors, stairways or access opening shall be placed in the space before enclosing the structure. After equipment is placed, it shall be thoroughly protected from damage.

1.13 CLEAN-UP

A. Remove debris and waste materials from within the construction areas and transport off-site, daily.

B. Keep the construction area clean, free from hazard, and orderly arranged.

C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.

D. Dispose of waste materials in accordance with all regulations which govern.

E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.

F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner’s satisfaction.

G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Unless otherwise indicated, provide only new equipment and materials.

B. On all major equipment components, provide manufacturer’s name, address, model number, and serial number permanently attached in a conspicuous location.

C. All materials furnished under these specifications shall be the standard product of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer’s latest approved standard design.

D. GUARANTEE

1. The Contractor and Manufacturers shall provide a TWO (2) YEAR guarantee for all work under the Electrical, HVAC, Plumbing and Fire Protection Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents. **In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect.**

2. All materials, items of equipment and workmanship furnished under each Section shall carry a TWO (2) YEAR warranty against all defects in material and workmanship. Any fault under any Contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other system resulting from this failure.

3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.

5. Additional extended guarantees required for work on this project. The additions and/or extensions to the standard one-year guarantee previously described are to be provided in writing, by the manufacturer or an approved insurance underwriter. The guarantee is to cover all parts and/or labor as specified below.

   Master Extended Guarantee List: (All items are not used on all jobs)

   a. Gas heat exchangers in all furnaces, make-up air heaters, “neutral air” make-up air units (MAU), unit heaters and packaged rooftop units (RTU) to have an additional nine (9) year parts only guarantee. (Non-prorated) Total 10 year max.

   b. All comfort air conditioning and heat pump compressors are to have an additional four (4) year parts only guarantee. (Non-prorated) Total 5 year max.

   c. All computer grade HVAC equipment compressors are to have an additional one (1) year parts only guarantee. (Non-prorated)

   d. All “neutral air” make-up air units (MAU) are to have the following additional guarantees (Non-prorated):

      1) Two (2) year total unit performance.

      2) Additional four (4) year parts on compressors.

3) Additional four (4) year parts and performance on total enthalpy and sensible recovery cores, wheels, heat pipes, plate and frame exchangers and run around loops.

4) Provide unit with one (1) spare belt for each fan and wheel to be used at Owner's discretion after the guarantee period expires.

5) Additional one (1) year parts and labor on entire make-up air unit package against water leaking into the unit and/or into the building through any roof curb mounted unit. Manufacturer's representative is to certify proper installation on each unit in writing.

6. Furnish, before the final payment is made, a written guarantee covering the above requirements.

7. Additional/extended guarantees listed above are Non-negotiable and can't be amended through the submittal process.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

A. The Contractor shall notify the General Contractor and other Subcontractors in ample time of the location of all chases, sleeves and openings required in the construction for the proper installation of his work. The Contractor shall do all core drilling of individual holes and all cutting for his work, except square or rectangular openings in the structural slabs, which shall be cut by the Contractor at locations shown on the drawings. In no case, however, shall a beam or column be cut without the approval of the Project Structural Engineer.

B. On completion of this work or as work progresses, the Contractor shall make all repairs and do all patching required as a result of the work under this contract. All patching shall be performed in a manner that will restore the surrounding work to its original conditions and to the satisfaction of the Owner.

C. Any cutting and patching necessary as a result of the Contractor's failure to notify the General Contractor of all the required openings, shall be at the expense of the Contractor.

3.02 OBLIGATIONS/RESPONSIBILITIES

A. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it, as a whole, without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.

B. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures, and for coordinating all portions of the work under his Contract.

C. The Contractor shall provide, without extra charge, all incidental items required as a part of the work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall

proceed with the work under the stipulation that a satisfactory job is required.

3.03 TESTS AND INSPECTIONS

A. Schedule, obtain, and pay for all fees and/or services required by local authorities and by these specifications, to test the mechanical systems as specified in these specifications.

B. Request for Tests: Notify the Architect a minimum of 24 hours in advance of tests. In the event the Architect does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.

C. Deficiencies: Immediately correct all deficiencies which are evidenced during the test and repeat test until system is approved. Do not cover or conceal piping, equipment, or other portions of the mechanical installations until satisfactory tests are made and approved.

D. Operating Tests: Upon request from the Architect, place the entire mechanical installation and/or any portion thereof, in operation to demonstrate satisfactory operation.

E. Log of Tests: The Contractor shall set up a testing log form to be kept at the job site with the record drawings. All tests shall have pertinent data logged at the time of testing. Pertinent data is to include date, time, description, personnel, system tested (and extent), test conditions, test results, etc.

F. Completion: Upon completion of the mechanical installation, demonstrate to the Architect's satisfaction that the systems have been installed in a satisfactory manner in accordance with the plans, specifications, and applicable codes. Demonstrate dynamic operation of all systems. Show that all controls are operable and are properly adjusted in accordance with the requirements of the final systems balance, that all systems are properly balanced, that all equipment operates properly, that filters and strainers are clean, and that all components of all systems are installed and adjusted for proper operation.

1. Prior to final inspection, all work under this Division to be completed. Insure all equipment is operational and final testing and balance reports have been submitted and approved.

3.04 OPERATING INSTRUCTIONS

A. Prior to final acceptance, instruct an authorized representative of the Owner on the proper operation and maintenance of all mechanical systems, equipment, and controls under this contract. Make available a qualified technician for each component of the installation for this instruction. Give these operation instructions after the operation and maintenance manuals have been furnished to the Owner. Submit written certification, signed by the Contractor, and an authorized representative of the Owner, that this has been completed.

3.05 COORDINATION OF WORK

A. Each Contractor shall compare his Drawings and Specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, all trades shall make proper provisions to avoid interferences in a manner approved by the Architect.

B. Each Contractor shall coordinate the location of his systems so that all outside air intakes are located in such a way as to prevent cross-contamination from plumbing vents, flue pipes, exhaust fans, etc. Such a distance shall be not less than 10 feet.

C. Locations of conduit, ducts, piping, sprinkler heads and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of system shall be determined prior to fabrication or installation. Coordinate routing of major electrical conduits with Electrical Contractor prior to fabrication of ductwork and piping.

D. Offsets and changes of direction in all conduit, ducts and piping systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.

E. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems and equipment, as determined by the Architect.

F. **The HVAC, Plumbing and Fire Protection Subcontractors shall verify with Electrical Subcontractor the available electrical characteristics for all motors and equipment before ordering and submitting of respective gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.**

G. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.

H. Mechanical Contractor and Controls Contractor shall coordinate all requirements of equipment and controls to insure a fully operational system.

I. Coordinate all plumbing rough-in through floor(s) with structural concrete TEE's/structural steel. Do not pass through stem of TEE's.

3.06 OPERATION AND MAINTENANCE MANUALS

A. Provide PDF of information requested, in organized, bookmarked format.

B. Provide Operation and Maintenance manual for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications, in organized PDF format, with bookmarks. In addition, organize manuals and include data and narrative as noted below. Provide PDF copy of O&M for owner records.

C. Operating Sequence and Procedures:

1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter. Also, include a copy of System Balancing Report.

2. Typewritten Operating procedures: Write procedures for start-up, operation, and shutdown.

a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.

b. Shutdown Procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instruction in that order.

D. Maintenance Instructions:

1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.

E. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide nearest manufacturers' representatives name, address and phone number.

F. Shop Drawings: Provide a copy of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturers' brochures or properly identified in a separate subsection.

G. Spare Parts Lists: Include a list of all equipment furnished for project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or system. Properly identify each part by part number and manufacturer.

H. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format.

3.07 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and it is the advantage of the Contractor to operate the equipment, he may do so providing that he properly supervises the operation. **All HVAC equipment shall be shut down when painting, sanding and similar construction operations detrimental to the equipment are being done.** The warranty period shall, however, not commence until such time as the equipment is operated solely for the benefit of the Owner at his request or as listed in ‘C’. Contractor shall clean any ductwork and equipment that is dirty due to equipment operation or improper protection.

B. **Any units that are operated during construction shall have filter media (Fiberbond Dual-Ply DustLok Media) placed over the exterior of return air grilles. Media shall be changed as frequently as required to keep ductwork clean.**

C. Regardless of whether or not the equipment has been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust the equipment and complete all punch list items before final acceptance by the Owner. The day following final acceptance by the Owner will be the start date of the warranty period.

3.08 RECORD FOR OWNER

A. Each Contractor shall accumulate and bind in an "Operating and Maintenance" manual the following data to be presented to the Owner at the completion of the Project.

1. All warranties and guarantees and manufacturer's instruction on equipment and material covered by the contract.

2. Approved equipment brochures, wiring diagrams and control diagrams.

3. Copies of approved shop diagrams.

4. Operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.

5. Repair parts lists of all major items and equipment including name, address and telephone number of local supplier or agent.

6. Valve tag charts and diagrams herein before specified.

7. HVAC balance and test results.

8. HVAC equipment start-up forms that include model and serial numbers of each piece of mechanical equipment installed, by unit mark number. For split units provide this information for all components.

9. "As-Built" Drawings as specified under "Construction Drawings" (these are not to be bound in the O&M Manual).

3.09 SITE OBSERVATION

A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item. Large projects may break up site walks by area, project must be 75,000 sqft or larger to request multiple site trips for same type of inspection. Minimum sqft size of divided inspection should be 30,000 sqft or larger.

B. **Contractor Readiness Forms:** Contractors are to complete all Contractor Readiness Forms from Engineer for each phase of inspection prior to calling for any engineering site inspections. Contractor Readiness Form must be acknowledged in writing and pictures when appropriate, some are room by room, some are per each piece of equipment depending on form. These forms must be completed, signed off by installing contractor as complete and General Contractor as verified, and submitted with request for calling for site inspections. If forms are incomplete, missing name of person verifying, missing phone number of person verifying, then site visit will not be scheduled.

C. **It shall be the duty of the Contractor to personally make a careful inspection of the entire project, assuring himself that the work on the project is ready for final acceptance and all Contractor Readiness Forms and Equipment Start-up form are completed (with no deficiencies), signed and submitted minimum 1 week before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense. (Minimum trip charge due to failure of final inspection readiness $2,500.)**

D. The final acceptance of the work will be made jointly by the Architect and the Owner.

E. Contractors are to obtain a Fieldwire Pro Software License of other software license required by MEP Engineer for the duration of the project. This software will be used to generate and respond to Field Reports.

1. Contractors that are required to obtain software:

a. Mechanical Contractor

b. Plumbing Contractor

c. Electrical Contractor

d. Test and Balance Contractor

e. Controls Contractor

f. General Contractor

3.10 MECHANICAL/ELECTRICAL

A. **<u>THIS IS TO BE DONE PRIOR TO SUBMITTING ELECTRICAL GEAR.</u> Contractor to submit Mechanical/Electrical equipment coordination sheet with equipment submittal for actual equipment (MAU's, RTU's, AHU's, CU's, HP's, HRU's, Airhawks, AFU's, HETD's, etc) being installed. Reference chart at end of section. This is for Contractor coordination purposes.**

3.11 START-UP REPORT VERIFICATION – Prior to Final Inspection Request

A. Controls Contractor, Mechanical Contractor and Test and Balance (T&B) Contractor must provide a signed document stating that all control integration, equipment start-up and complete test and balance (no deficiencies) has been completed prior to final mechanical inspections or initial Commissioning visit. Control integration equipment start-up and T&B reports that include outstanding deficiencies are not considered complete. All final start-up reports are to be submitted to Engineer, prior to final inspection request. All forms must include signature and phone number of person completing. Partial completed form will not be accepted, payment for Equipment Start-Up will be zero dollars until 100% of Start-Up forms are completed, deficiencies corrected and submitted to Engineer.

3.12 CERTIFICATE OF COMPLETION

A. Submit, at time of request for final inspection, a completed letter in the following format:

1. I, (Name) , of (Firm) , certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of (Date). I further certify that the following specification requirements have been fulfilled:

2. Test and Balance Completed, final report attached with no deficiencies.

3. Mechanical Equipment Start-up completed, documentation attached.

4. Factory Equipment Start-up completed, documentation attached.

5. Controls Start-up completed, documentation attached.

6. Contractor Readiness Forms Completed documentation attached.

7. Commissioning Forms, Reports, Functional Test etc completed, documentation attached.

8. Final Clean up Completed.

9. Fresh Set of Filters installed.

10. All Systems are Fully Operational.

11. Record drawings up-to-date and ready to deliver to engineer.

- Signed: _____

3.13 **BIM PROTOCOLS**

The following protocols apply to the production, use of, and limits of the electronic model used by, or created by Hendrix Consulting Engineers (HCE) as part of the project Building Information Modeling (BIM) process and specific to the Mechanical, Electrical, Plumbing (MEP) systems or this part of the Project designed by HCE.

The definitions, terms and limits, and descriptions herein shall supersede any contract terms and conditions relating to BIM, or BIM Execution Plan, or similar BIM article(s), when applied to HCE, included as part of the Project.

Purpose of the Model:
The electronic model is an instrument of service, intended for the production of 2-Dimensional (2D) Contract Documents via a 3-Dimensional (3D) design and coordination process. Hendrix Consulting Engineers (HCE) may choose to model those elements determined suitable for 3D coordination. However, the model will not Include all elements necessary for complete MEP systems design and installation nor will it include all elements and requirements reflected on the 2D Contract Documents, which include the Project drawings and specifications.

Expectations for Limits of Modeled Elements:
The model will be used for coordination between design team members as outlined in the Level of Development section below. At the onset of the Project, the design team will agree on the limits of modeled elements.

Generally, modeled elements will include the following:

- HVAC: Pipes greater than 3" (nominal size, not including insulation), ductwork modeled at a design level for general design intent, equipment, and diffusers, registers, grilles, and louvers.
- Plumbing: Piping greater than 3' (nominal size, not including Insulation), equipment, fixtures.
- Electrical: Light fixtures, distribution equipment and panels.

The model will generally **not** Include the following:

- Flanges, fittings, hangers, pull boxes, seismic restraints, and other assembly data subject to the means and methods of construction.
- Thermostats, sensors, detectors, switches, and other wall/ceiling devices denoted by symbol on the plans.
- Dampers and duct accessories with some exceptions at the discretion of HCE.
- Valves and pipe specialties with some exceptions at the discretion of HCE.
- Specific connections to equipment with some exceptions at the discretion of HCE.
- Exterior pipe and duct Insulation and interior ductwork liner will not be modeled.
- Fire Protection systems other than the main piping and components used to develop the performance design.
- Conduit and panels for automated control systems
- Conduit and devices for Fire Alarm systems
- Other “performance design” elements will not be modeled.
- Accurate quantities suitable for estimating, construction, or cataloguing.
- Specific manufacturer information other than where HCE, at its sole discretion, chooses to include such information.
- Representation or controlling criteria in regard to the sequencing of construction. Any such information presented by the model is coincidental.
- Fully coordinated systems.

Other stipulations:

- Under no conditions may the model be used for fabrication or quantity take-offs.
- If the model Is forwarded to the Contractor and/or subcontractors, the Contractor and subcontractors may only use the model as a reference-only model to understand design intent.

As noted herein, the model is an instrument of service. As such, any Information contained in the model is subordinate to the printed, 2D Contract Documents. In the case of any conflicts or differences, the 2D Contract Documents are the controlling documents.

Level of Development (LOD):
The following LOD descriptions shall apply to the work performed by, and model provided by, Hendrix Consulting Engineers (HCE). These descriptions include the content requirements and associated authorized uses for each progressively detailed LOD. Each subsequent LOD builds on the previous LOD. The model content requirements apply only to those systems, components, and assemblies HCE chooses to include within the model. The authorized uses noted herein constitute the only allowed uses of the model.

LOD 100
Model Content Requirements. Basic spatial requirements and system concepts used to support the development of the architectural model. Systems and components are not modeled for dimensional or location accuracy.
Authorized Uses. The model may be used to generate 2D drawings representing the design concept. The model may be used by the design team for developing concepts and coordination criteria.

Application. An LOD 100 model will apply to Concept Design and Schematic Design phases.

LOD 200
Model Content Requirements. Model elements are modeled as generalized systems, components, or assemblies with approximate quantities, sizes, shapes, and locations and shall not be considered as "dimensionally accurate." Non-geometric information may be attached to Model Elements at the sole discretion of HCE. While modeled elements are intended to support the coordination process, modeled elements shall not be considered coordinated at this LOD.
Authorized Uses. The model may be used to generate 2D drawings representing the status of the design. The model may be used by the design team to coordinate rights-of-way for major system components. The model may be used for clash detection by the design team within the limits of expectations defined herein. HCE will not respond to itemized clash reports at this level as modeled elements are not considered coordinated at this level. Clash detection reports will be used as coordination for CD phase documentation only.
Application An LOD 200 model will apply to the Design Development phase.

LOD 300
Model Content Requirements. Model elements are modeled as generalized systems, components, or assemblies with approximate quantities, sizes, shapes, and locations and shall not be considered as "dimensionally accurate." Non-geometric Information may be attached to Model Elements at the sole discretion of HCE. At this LOD and at the sole discretion of HCE, specific model elements accurate in terms of size and shape may be included. These elements may or may not be imported from specific manufacturers in order to define a basis of design. Where equipment elements are shown, HCE makes no representation of the accuracy of the elements since any manufactured equipment or component is subject to continual change and alternate manufacturers are typically permitted. While modeled elements are intended to support the coordination process at a more detailed level, modeled elements shall not be considered completely coordinated at this LOD.
Authorized Uses. The model may be used to generate 2D drawings representing the status of the design. The model may be used by the design team to coordinate rights-of-way for major system components, primary system components, and secondary distribution components. The model may be used for clash detection by the design team within the limits of expectations defined herein.
Application. An LOD 300 model will apply to the Contract Document phase.

LOD 400:
Model Content Requirements. Model elements are modeled as specific systems, components, or assemblies that are accurate in terms of size, shape, location, and quantity with fabrication, assembly, and detailing information. Non-geometric information may be attached to Model Elements. Where possible, elements are modeled from actual manufacturer's data to include information specific to the selected manufacturers.
Authorized Uses. The Contractor may choose to produce an LOD 400 model to generate 2D coordination drawings and/or for detailed, 3D installation coordination among the construction team. During this process the design model, which is not an LOD 400 model, may be used by the construction team as a reference-only document to help clarify the design Intent.
Application. An LOD 400 model will apply to the Shop Drawing and Construction Coordination phases and is the responsibility of the Contractor. The Scope of Work for Hendrix Consulting Engineers (HCE) does not include an LOD 400 model.

LOD 500:
Model Content Requirements. Model elements are modeled as actual constructed (As-built) systems, components, and assemblies accurate in terms of size, shape, location, and quantity. Non-geometric Information including Operation and Maintenance Data and linked submittal data is attached to Model Elements where applicable.

Authorized Uses. The model may be used for maintaining, altering, and adding to the Project, but only to the extent consistent with any license granted in other binding Agreements or Contracts or in a separate licensing agreement.

Application. An LOD 500 model will apply to the As-Built phase and is the responsibility of the Contractor. The Scope of Work for HCE does not include an LOD 500 model.

Clash Detection:
It is expected clash detection will be performed by the design team to aid in design coordination. Due to the limits of available software, elements identified as “clashing" may not actually be in conflict and should not be construed as conflicts or errors on the part of the design team. If clash detection will be utilized, an agreement will be made as to what constitutes a “clash' and when resolution of clashes is required. The model is a design tool rather than an installation tool. Therefore, some clashes are expected and may be left in place where a construction resolution is available.

Insomuch as we do not have complete control over the design, selection of materials, or sequencing of construction for the Project, HCE makes no representation that the model will be "clash-free" or without conflicts requiring resolution by the Contractor during the formal production of Shop Drawings and field Coordination Drawings.

Availability of Model.
The model will be made available subject to the Terms of the Prime Agreement.

Contractor’s Role:
The Contractor is solely responsible for the decisions made for their use of the model. The Contractor is ultimately responsible for the complete and coordinated installation of all systems depicted on the Contract Documents, whether or not said systems are completely depicted within the model. The model, as an instrument of service, is not intended to dictate means and methods, scheduling requirements, sequencing, or exact quantities; these requirements are the sole responsibility of the Contractor.

Integrated Project Teams:
When integrated project teams, such as Design/Assist, Design/Build, Lean Design, or CM/GC, are part of the project the terms herein shall still apply. However, the project team may alter certain aspects of these terms to allow shared roles in regard to the development of the model. Any such alterations must be approved by HCE and Shall be implemented without additional liability to HCE.

Ownership of Documents:
The model, and all documents produced by Hendrix Consulting Engineers (HCE) under this agreement shall remain the property of HCE and may not be used by the Client for any other endeavor without the written consent of HCE.

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FIRM F-4095 FAX: (512) 218-0077

PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.

B. 2 Submittal CATEGORIES (Reference Specifications)

a. Not required unless deviating from specification

b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures
Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:
Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.

D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

E. **Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.**

F. **Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.**

G. **Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.**

H. **Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."**

I. **Call before submitting a written RFI.**

J. **All formal Job emails must come from Architect.**

K. **Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.**

L. **All equipment that will be controlled by or monitored by the DDC System must include the information needed by the Controls Contractor to properly integrate the equipment with the Controls System.**

M. **All equipment submittals to include a detail instruction on what needs to be set up in the field when the equipment is started up and step-by-step instructions on how to complete the set-up. Do no submit generic information that covers multiple types of equipment. The instructions must be specific to the equipment scheduled with all of the accessories and sequences specified.**

Shop Drawings and Cad Files

A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.

B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.

C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.

D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.

E. Schedule and Details sheets will not be released.

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph:

Drawings and Details Affected:

Proposed Substitution/Description:

Installer's Name:

Manufacturer's name:

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____# of pages including cover)

Why is Substitution Being Submitted?

☐Pre-Bid Substitution (Prior Appoval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.
☐Specified product is not available. Explain in detail as attachment.
☐Cost Savings to Owner. Indicate comparative cost analysis as attachment.
☐Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

A. Does substitution affect dimensions shown on drawings? ☐No ☐Yes
B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐No ☐Yes
C. What affect does substitution have on other trades?

_____

D. Differences between proposed substitution and specified item?

_____

E. Indicate how proposed substitution meets LEED requirements. (if applicable)
F. Manufacturer's guarantees of proposed and specified items are:
☐Same ☐Different (explain on attachment)

The Contractor and Subcontractor certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respectes to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Similar maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

_____

_____

_____

_____

_____

For A/E Use: SR# _____

☐Accepted ☐Accepted as Noted
☐Not Accepted ☐Received Too Late
☐Incomplete Information
☐No Substitutions Accepted
Reviewed by/date: _____
Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:
☐FILE ☐OWNER ☐CONTRACTOR
☐ENGINEER ☐_____

MEP/ENERGY CONSULTANTS
HCE HENDRIX CONSULTING ENGINEERS
COMMISSIONING • FIELD INVESTIGATIONS

115 E. Main Street
Round Rock, Texas 78664
(512)218-0060-office
(512)218-0077-fax

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

MECH / ELEC EQUIPMENT COORDINATION SHEET

(THIS IS REQUIRED – NOT OPTIONAL)

ELECTRICAL CONTRACTOR TO REVIEW AND SIGN (EACH PAGE) PRIOR TO MECHANICAL EQUIPMENT SUBMITTAL OR ELECTRICAL GEAR SUBMITTAL.

ELECTRICAL CONTRACTOR:_____

MECHANICAL CONTRACTOR:_____

MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE	MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

PLBG / ELEC EQUIPMENT COORDINATION SHEET

(THIS IS REQUIRED – NOT OPTIONAL)

ELECTRICAL CONTRACTOR TO REVIEW AND SIGN (EACH PAGE) PRIOR TO PLUMBING EQUIPMENT SUBMITTAL OR ELECTRICAL GEAR SUBMITTAL.

ELECTRICAL CONTRACTOR:_____

PLUMBING CONTRACTOR:_____

MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE	MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE

END OF SECTION

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Pre - Wall Cover-Up
Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE COMMON ITEMS NOTED FOR THIS INSPECTION AND MUST BE CHECKED IN EVERY ROOM PRIOR TO REQUESTING AN ABOVE CEILING INSPECTION FOR THAT ROOM.

GENERAL ITEMS:

Completed ( ) / Initials

❑/_____ITEM NO.1: WHERE EXTERNAL INSULATION TERMINATES, SEAL INSULATION TO DUCTWORK WITH MASTIC AND 3" GLASS FIBER REINFORCING MESH PER SPECIFICATION SECTION '20 07 00, 3.04, C.'.

❑/_____ITEM NO.2: FOR ALL ROOF MOUNTED MECHANICAL EQUIPMENT, ONLY CUT ROOF DECK FOR DUCT DROPS. SPECIFICATION SECTION

❑/_____ITEM NO.3: WHEN REFRIGERANT PIPING IS LOCATED BEHIND WALLS, INSURE REFRIGERANT PIPING DOES NOT COME IN CONTACT WITH STEEL STUDS OR CLAMPS, AND HAS NAIL/SCREW PROTECTION AT STUDS. SPECIFICATION SECTION

❑/_____ITEM NO.4: RAINLEADER PIPE SIZE MAY NOT BE REDUCED IN DIRECTION OF DISCHARGE, MUST REMAIN FULL SIZE INCLUDEDING DROPS. RAINLEADER PIPING, RAINLEADER BODY AND FLANGES MUST BE INSULATED PERS SPECIFICATION

❑/_____ITEM NO.5: HORIZONTAL MC CABLE IS NOT ALLOWED IN WALL CAVITY. SPECIFICATION SECTION

❑/_____ITEM NO.6: FOR ALL DEVICE ROUGH-IN NEAR DOOR, FOLLOW DETAIL ON ELECTRICAL SHEETS. USE CADY BRACKETS TO GET MULTPLE DEVICES IN SINGLE STUD SPACE. ALL SWITCHES, THERMOSTATS, INTERCOM BUTTONS, WALL FIRE ALARM DEVICES INSTALLED BY DOOR PER ROUGH-IN DETAILDEVICES SHOULD NOT EXTEND OVER 24" FROM DOOR FRAME. NO DEVICES SHOULD BE ROUGHED-IN, THAT WOULD CONFLICT WITH CABINETS OR WHITE BOARDS. ITEMS DEVIATING FROM DETAIL THAT CAUSE OWNER PROBLEMS WILL BE RELOCATED EVEN AFTER SHEETROCK INSTALLED. SPECIFICATION SECTION

❑/_____ITEM NO.7: ALL EXPOSED EXTERIOR CONDUIT FROM GRADE TO PANEL OR 36" AND BELOW, MUST BE RIGID PIPE. CONDUIT NOT FOLLOWING SPECIFICATION WILL HAVE TO BE REMOVED

AND REPLACED, EVEN IF WIRE HAS ALREADY BEEN PULLED. PAY SPECIAL ATTENTION TO EXTERIOR RACK MOUNTED SERVICES. SPECIFICATION SECTION

❑/_____ITEM NO.8: ALL CONDUIT AND J-BOX STRAPS AND SPACING MUST BE PER CODE.

❑/_____ITEM NO.9: TECHNOLOGY AND POWER TO BE WITHIN 6" OF EACH OTHER OR IN SAME STUD SPACE WHEN SHOWN TOGETHER. REFERENCE POWER AND TECHNOLOGY PLANS. REFERENCE BLOCK NOTE ON POWER PLANS. DEVICES INTENDED TO BE LOCATED NEXT TO EACH OTHER THAT ARE NOT IN THE SAME STUD SPACE WILL BE RELOCATED, EVEN AFTER SHEETROCK. SPECIFICATION SECTION

❑/_____ITEM NO.10: CONFIRM TRANSFER DUCTS INSTALLED IN ALL WALLS TO DECK WHEN SHOWN ON PLANS OR REQUIRED FOR RETURN AIR PATH. PROVIDE PLAN HIGHLIGHTING ALL WALLS TO DECK AND INSTALLED TRANSFERS. SPECIFICATION SECTION

❑/_____ITEM NO.11: WHEN CONDUIT PENETRATES FLOOR, HOLES IN SUSPENDED SLABS, HOLES MUST BE SEALED FROM TOP AND BOTTOM PRIOR TO CLOSING UP WALLS. SPECIFICATION SECTION

❑/_____ITEM NO.12: PROVIDE DRAWING SHOWING LOCATION AND SIZE OF ALL WATER HAMMER ARESSTORS INSTALLED. MUST BE INSTALLED AND SIZED PER SPECIFICAITON AND MANUFACTURES INSTALLATION INSTRUCTION. SPECIFICATION SECTION

❑/_____ITEM NO.13: ENSURE GROUNDING/BONDING BUSHINGS ON ALL PANEL CONDUITS AND GROUNDING CONDUITS FROM TRANFORMERS. SPECIFICATION SECTION

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Pre - Above Ceiling
Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE COMMON ITEMS NOTED FOR THIS INSPECTION AND MUST BE CHECKED IN EVERY ROOM PRIOR TO REQUESTING AN ABOVE CEILING INSPECTION FOR THAT ROOM.

GENERAL ITEMS:

Completed ( ) / Initials

❑/_____ITEM NO.1: CONFIRM ALL RUN OUT TAPS HAVE BALANCING DAMPERS WITH STAND-OFF MOUNTING BRACKETS PER SPECIFICAN AND DETAILS. SPECIFICATION SECTION

❑/_____ITEM NO.2: CONFIRM ALL EXHAUST DUCT WITHIN 36” OF ROOF DECK OR EXTERIOR WALL IS INSULATED PER PLANS AND SPECIFICATIONS. SPECIFICATION SECTION

❑/_____ITEM NO.3: CONFIRM RETURN AIR PATH BACK TO ALL UNITS IS NOT BLOCKED BY WALLS TO DECK. CONFIRM ALL TRANSFERS HAVE BEEN INSTALLED. PROVIDE PLAN HIGHLIGHTING WALLS TO DECK AS INSTALLED AND HIGHLIGHTING AIR TRANSFERS INSTALLED FOR REVIEW. THIS IS FOR REVIEW TO CONFIRM IF ANY ADDITIONAL TRANSFERS ARE REQUIRED OR OPENING ABOVE CEILING NEED TO BE CUT INTO SHEET ROCK ON WALLS TO DECK PRIOR TO CEILING COVER UP. SPECIFICATION SECTION

❑/_____ITEM NO.4: REFRIDGERANT PIPING: CONFIRM ALL REFRIGERANT PIPING IS COMPLETELY INSULATED AND INSULATION SEALED, INCLUDING CONTINIOUSLY THROUGH WALLS. ENSURE PIPE SADDLES ARE INSTALLED AT ALL SUPPORTS FOR REFRIGERANT PIPING. SPACING PER SPECIFICATIONS

❑/_____ITEM NO.5: CONFIRM BACK OF ALL SUPPLY GRILLES ARE INSULATED. SPECIFICATION SECTION

❑/_____ITEM NO.6: ALL EXTERIOR LIGHTS SEALED TO BUILDING.

❑/_____ITEM NO.7: CONFIRM ANY DAMAGED INSULATION FOR DUCTWORK, WATER PIPING, REFRIGERANT PIPING IS REPAIRED AND PROPERLY SEALED TO PREVENT CONDENSATION.

SPECIFICATION SECTION

❑/_____ITEM NO.8: CONFIRM ALL PENITRATIONS THROUGH FIRE WALLS HAVE BE CAULKED. SPECIFICATION SECTION

❑/_____ITEM NO.9: CONFIRM ACCESS DOORS ARE PROVIDED FOR ALL FIRE/SMOKE DAMPERS AND OTHER REQUIRED LOCATIONS, PER DETAILS, SPECIFICATIONS FOR ACCESS TO REQUIRED COMPONENTS. ENSURE ACCESS DOORS ARE PROVIDED IN DUCTWORK AS DECRIBED IN RTU AND AHU DETAILS AT FIRST 90° TURN FOR RTU AND BOTH SUPPLY AND RETURN OF AHU. REFERENCE SPECIFICATION FOR PROPER SIZE AND SPACING.

❑/_____ITEM NO.10: CONFIRM ALL MECHANICAL UNITS, WATER HEATERS, PANELBOARDS, TRANSFORMERS ETC.. ARE LABELED WITH ALL REQUIRED INFORMATION AND WITH PROPER MATERIAL PER SPECIFICATION ’20 01 00, 3.05, B’.

❑/_____ITEM NO.11: CONFIRM ALL CABLES ARRE INDEPENDANTLY SUPPORTED PER SPECIFICAITON. CONTROLS, FIRE ALARM, LIGHTING CONTROL, POWER, TECHNOLOGY, INTERCOM ETC.. SPECIFICATION SECTION

❑/_____ITEM NO.12: CONFIRM INSULATION IS SEALED AT ALL HANGERS. SPECIFICATION SECTION

❑/_____ITEM NO.13: CONFIRM ISOLATORS ARE INSTALLED AT ALL EQUIPMENT AS REQUIRED BY SPECIFICATION AND DETAILS. SPECIFICATION SECTION

❑/_____ITEM NO.14: FOR ALL EXTERIOR EQUIPMENT: CONFIRM HAIL GUARDS ARE INSTALLED IMEDIATELY WHEN UNIT IS INSTALLED AT SITE TO PREVENT HAIL DAMAGE FROM OCCURING. HAIL DAMAGE DURING CONSTRUCTION DUE TO NOT INSTALLING HAIL GUARDS IS CONTRACTORS RESPONSIBILITY. SPECIFICATION SECTION

❑/_____ITEM NO.15: ROOF MOUNTED CONDENSING UNITS: CONFIRM ALL ROOF MOUNTED CONDENSING UNIT ARE INSTALLED ON THY-CURBS, ALL METAL CROSS SUPPORTS ARE GALVANIZED AND CUT ENDS ARE PAINTED WITH GALVANIZED PAINT. ALL CONDENSING UNITS MUST BE PROPERLY SECURED TO THY-CURB PER DETAIL. NO PENITRATIONS ALLOWED IN TOP OF THY CURB. INSURE ALL SIDE DISCHARGE CONDENSING UNIT ARE AIMED CORRECTLY AND NOT BLOWING INTO INTAKE OF ADJACENT CONDENSING UNIT. INSURE ALL SIDE DISCHARGE CONDENSING UNIT HAVE AIR DIRVERTER INSTALLED CORRECTLY IN THE UP POSITION. SPECIFICATION SECTION

❑/_____ITEM NO.17: EXTERIOR REFRIGERATION PIPING: INSURE ALL EXTERIOR REFRIGERANT PIPING INSULATION IS WEATHER PROOFED

WITH ALUMINUM WRAP PER SPECIFICATIONS.
SUPPORTED PROPERLY AND INSTALLED IN MANNER THAT DOES NOT IMPEAD MAINTANANCE ACCESS.
SPECIFICATION SECTION

❑/_____ITEM NO.19: INSULATION THROUGH WALLS: VERIFY ALL DUCTWORK, PIPING, AND REFIGERATION PIPING INSULATION IS CONTINUOUS THROUGH WALLS. BREAKS IN INSULATION INSIDE WALL WILL CAUSE CONDENSATION AND MOLD SPECIFICATION SECTION

❑/_____ITEM NO.21: PIPING LABELING: CONFIRM ALL PIPING IS LABELED WITH WATER TYPE AND DIRECTIONAL ARROWS, WITH PROPER COLOR, SIZE, SPACING PER SPECIFICATION SECTION '20 01 00, 3.09, C'.

❑/_____ITEM NO.22: CONFIRM ALL VALVES ARE TAGGED PER SPECIFICATION SECTION '20 01 00, 3.05, A'. PROVIDE MAP OF ALL LOCATION IN PDF FORM TO OWNER.

❑/_____ITEM NO.23: PROVIDE CEILING ACCESS MARKERS FOR ALL MECHANICAL UNITS, VALVES, ETC… PER SPECIFICATION SECTION '20 01 00, 3.05, D'.

❑/_____ ITEM NO.25: INSURE ALL REFRIDGERANT PIPING, WATER PIPING AND DUCTWORK SUPPORTS ARE PROVIDED PIPE SADDLES UNDER HANGERS AS REQUIRED FOR ALL LOCATIONS. SUPPORT SPACING MUST BE PER SPECIFICAITONS

❑/_____ ITEM NO.26: EXTERIOR MEP PENITRATIONS: ALL PENITRATION THROUGH EXTERIOR WALLS/DRAINPLANES MUST BE SEALED WATER TIGHT PER DETAILS AND SPECIFICATIONS. INCLUDING BUT NOT LIMITED TOO: RAINLEADER, CONDUIT, HOSE BIBBS, REFRIGERANT PIPING, FIRE SPRINKLER TEST PIPE, LIGHT FIXTURES, RECEPTACLES, WATER PIPING PENETRATIONS ETC… SPECIFICATION SECTION

❑/_____ ITEM NO.28: PIPING SUPPORTS: INSURE PROPER PIPING SUPPORTS ARE USED TO SUPPORT DISIMALER METALS PER SPECIFICATION SECTION

❑/_____ ITEM NO.29: GAS PIPING ON ROOF: ALL BRANCH GAS TAP MUST BE TAPPED OFF TOP OF MAIN GAS LINE. DIRT LEG MUST BE INSTALLED AT ALL UNIT CONNECTIONS MINIMUM 3" ABOVE ROOF. ALL GAS PIPING MUST BE PRIMED AND PAINTED. MUST BE SPORTED WITH PPI TYPE ROLLER SUPPORTS WITH PROPER SPACING PER SPECIFICATION SECTION

❑/_____ ITEM NO.30: PEX PIPING SUPPORTS(WHEN USED): INSURE CORRECT PEX ISOLATION FITTINGS ARE BEING USED TO SUPPORT PEX PIPING IN WALL. CONFIRM CORRECT CONTINIOUS PEX SADDLE SUPPORT IS BEING USED FOR PEX ABOVE CEILING, TO MAINTAIN FLAME SMOKE RATING.

SPECIFICATION SECTION

❑/_____ ITEM NO.33: LABEL ALL J-BOXES WITH CIRCUIT AND PANEL NUMBERS. SPECIFICATION SECTION

❑/_____ ITEM NO.34: CONFIRM ALL TRANSFORMER GROUND CONNECTIONS HAVE BEEN INSTALLED. SPECIFICATION SECTION

❑/_____ ITEM NO.35: CONFIRM ALL UNUSED OPENINGS IN JUNCTION BOXES ARE PROPERLY SEALED. SPECIFICATION SECTION

❑/_____ ITEM NO.36: CONFIRM REMOVAL OF ALL TEMPORARY AND UNUSED WIRING AND LIGHTING WHEN APPROPRIATE. SPECIFICATION SECTION

❑/_____ ITEM NO.37: CONFIRM LABELING AND PAINTED RED ALL FIRE ALARM JUNCTION BOXES. SPECIFICATION SECTION

❑/_____ ITEM NO.38: CONFIRM ALL J-BOXES ABOVE CEILINGS ARE ACCESSIBLE. SPECIFICATION SECTION

❑/_____ ITEM NO.39: CONFIRM ALL FLEX CONDUIT ABOVE CEILING IS INDEPENDENTLY STRAPPED. SPECIFICATION SECTION

❑/_____ ITEM NO.40: CONFIRM DUCT DETECTORS ARE INSTALLED WHERE REQUIRED. REFERENCE UNIT SCHEDULE, FIRE ALARM SHOP DRAWINGS AND UNITS OVER 2000 CFM. REFERENCE SPECIFICAITON

❑/_____ ITEM NO.41: CONFIRM ALL CEILING MOUNTED EXIT SIGNS ARE SECURED TO STRUCTURE. SPECIFICATION SECTION

❑/_____ ITEM NO.42: CONFIRM ALL LIGHT FIXTURES HAVE INDEPENDENT SUPPORTS ON MINIMUM 2 CORNERS AND CONFIRM THEY ARE SECURED TO STRUCTURE. SPECIFICITON SECTION

❑/_____ ITEM NO.44: ROOF MOUNTED TRANSFORMERS AND PANELS: INSTALL ON THY-CURBS PER DETAIL. ALL STEEL CROSS SUPPORT TO BE HOT DIP GALVANIZED, CUT ENDS PAINED WITH GALVANIZING PAINT. PROVIDE FOOTPLATE AND RUBBER ISOLATER PAD UNDER FEET OF TRANSFORMER. PROPERLY SECURE TRANSFORMER AND PANEL TO SUPPORT, DO NOT PENITRATE TOP OF THY CURB. DO NOT LEAVE METAL SHAVINGS CAUSING RUST WHEN CUTS ARE MADE. SPECIFICATION SECTION

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Pre - Final Punch Inspection
Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE REQUIRED TO BE ADDRESSED AND SIGNED OFF IN WRITING BY CONTRACTOR FOR EACH UNIT OR ROOM AS INDICATED BY INDIVIDUAL ITEMS BELOW. THESE ITEMS MUST BE COMPLETED AND SUBMITTED WITH ANY DEFICIENCIES CORRECT PRIOR TO REQUESTING FINAL MEP INSPECTION.

GENERAL ITEMS:

COMPLETED ( ) / INITIALS

❑/_____ITEM NO.1: ALL MECHANICAL UNITS: PROVIDE CONTRACTOR READINESS CHECKLIST (START-UP FORMS),

- MECHANICAL CONTRACTOR - START-UP REPORTS
- MANUFACTURER START-UP FORM (WHEN REQUIRED)
- MECHANICAL START-UP FORM
- CONTROLS START-UP FORM
- TEST-BALANCE WITH ALL DEFICIENCIES ADDRESSED.
- COMMISSIONING FOR ALL MECHANICAL UNITS AS LISTED IN SPECIFICATION. SCHEDULE OF VALUE LINE ITEM WILL NOT BE PAID UNTIL ALL FORMS FOR ALL EQUIPMENT HAVE BEEN COMPLETED, SUBMITTED AND REVIEWED. PARTIAL PAYMENT WILL NOT BE PROVIDED. SPECIFICATION SECTION 20 00 00.

❑/_____ITEM NO.2: PROVIDE TEST AND BALANCE REPORT WITH ALL DEFICIENCIES ADDRESSED AND WITH DISCHARGE AIR TEMPS IN COOLING MODE PER SPECIFICATIONS.

❑/_____ITEM NO.3: CONFIRM ALL THERMOSTATS CALIBRATED AND ADJUSTED TO + OR – 1 DEGREE ACCURACY. PROVIDE SIGNED FORM FOR ALL SENSORS.

❑/_____ITEM NO.4: CONFIRM LABELING ALL THERMOSTATS PER SPECIFICATION SECTION ’20 01 00, 3.05, C.’.

❑/_____ITEM NO.5: DUCTWORK AND INSIDE OF MECHANICAL UNITS TO BE CLEANED.

❑/_____ITEM NO.6: CLEAN SET OF FILTERS TO BE INSTALLED IN ALL UNITS.

❑/_____ITEM NO.7: CHECK DISCHARGE AIR TEMPERATURE OFF OF ALL COOLING UNITS. (INCLUDE DISCHARGE AIR IN COOLING FOR EACH STAGE OF COOLING, MUST BE 56 DEGREES OR COOLER, REFERENCE START-UP FORMS)

❑/_____ITEM NO.8: CHECK DISCHARGE AIR TEMPERATURE AND HUMIDITY OFF OF ALL MAKEUP/OUTSIDE AIR UNITS. (MUST BE 53 DEGREES OR COOLER OFF COIL)

❑/_____ITEM NO.9: PROVIDE LABEL AND DIRECTIONAL ARROWS ON BOTH SIDES OF LABELS ON ALL PIPING PER SPECIFICATION SECTION ’20 01 00, 3.09, C.’, INCLUDING ABOVE CEILING AND WATER HEATER ROOMS.

❑/_____ITEM NO.10: TAG ALL VALVES PER SPECIFICATION SECTION ’20 01 00, 3.05, A.’.

❑/_____ITEM NO.11: PROVIDE CEILING ACCESS MARKERS PER SPECIFICATION SECTION ’20 01 00, 3.05, D.’.

❑/_____ITEM NO.12: LABEL ALL EQUIPMENT PER SPECIFICATION SECTION ’20 01 00, 3.05, B.’.

❑/_____ITEM NO.13: SINKS:

- CONFIRM ALL EXPOSED SINK WASTE PIPE HAS ‘ADA’ PADDING INSTALLED.
- CONFIRM TMV LOCATED AT EACH SINK REQUIRED ON PLUMBING FIXTURE SCHEDULE.
- PROVIDE AS BUILT OF WATER HAMMER ARRESTORS SIZE AND LOCATION.

❑/_____ITEM NO.14: LABEL PANELBOARDS PER SPECIFICATION SECTION ‘26 05 00, 3.09, K. INCLUDE ALL INFORMATION REQUIRED, AND TYPED PANELBOARD SCHEDULES WITH ROOM NAMES.

❑/_____ITEM NO.15: PROVIDE FACTORY START-UP AND PROGRAMMING OF ‘NLIGHT’ LIGHTING CONTROLS. PROVIDE DOCUMENTATION THAT THIS FACTORY PROGRAMMING HAS OCCURRED.

❑/_____ITEM NO.16: PROVIDE DOCUMENTATION THAT MANUFACTURER ONSITE TESTING HAS BEEN COMPLETED FOR SURGE PROTECTION.

❑/_____ITEM NO.17: PROVIDE DOCUMENTATION FOR TRANSFORMERS THAT MANUFACTURER HAS VERIFIED CONNECTIONS AND TESTED USB PORT FUNCTION.

❑/_____ITEM NO.18: CLEAN ALL CONSTRUCTION DEBRIS FROM INSIDE UNITS AND ON ROOF.

❑/_____ITEM NO.19: VERIFY THAT MECHANICAL CONTROL SYSTEM IS COMPLETE.

- ENSURE THAT ACCESS TO CONTROLS IS CONNECTED AND OPERATIONAL.
- OWNER SCHEDULE HAS BEEN INPUT.
- ALL SEQUENCES OF OPERATION FUNCTION PROPERLY
- ALL CONTROL START-UP FORMS COMPLETED AND SUBMITTED.
- ENGINEER WILL REQUIRE ACCESS TO CONTROL SYSTEM DURING FINAL VISIT. PROVIDE ACCESS CODES AND PASSWORDS TO ENGINEER.

❑/_____ITEM NO.20: ALL MECHANICAL, ELECTRICAL AND PLUMBING EQUIPMENT MUST BE POWERED UP AND OPERATIONAL.

❑/_____ITEM NO.21: PAINT AND PRIME ALL GAS PIPING PER SPECIFICATIONS.

❑/_____ITEM NO.22: ROOF SUPPORTS:

- PROVIDE CARRY TREAD / WALK PAD UNDER ALL ROOF SUPPORTS (GAS PIPING, CONDENSATE DRAINS, ETC.) REFERENCE ROOFING SPECIFICATION FOR ALL REQUIREMENTS.
- SUPPORTS PROVIDED PER SPACING REQUIREMENTS IN SPECIFICATIONS.

❑/_____ITEM NO.23: VERIFY INSTALL AND TEST DRAIN PAN FLOAT SWITCH.

❑/_____ITEM NO.24: DUCT ACCESS DOORS: CONFIRM ACCESS DOORS ARE PROVIDED FOR ALL FIRE/SMOKE DAMPERS AND OTHER REQUIRED LOCATIONS, PER DETAILS, SPECIFICATIONS FOR ACCESS TO REQUIRED COMPONENTS. ENSURE ACCESS DOORS ARE PROVIDED IN DUCTWORK AS DECRIBED IN RTU AND AHU DETAILS AT FIRST 90° TURN FOR RTU AND BOTH SUPPLY AND RETURN OF AHU. REFERENCE SPECIFICATION FOR PROPER

SIZE AND SPACING.

❑/_____ITEM NO.25: ALL WEATHERPROOF RECEPTACLE COVERS ARE REQUIRED TO BE METAL PER SPECIFICATION. PLASTIC NOT ALLOWED.

❑/_____ITEM NO.26: WATER HEATER INSTALLATION CONTRACTOR READINESS CHECKLIST.

❑/_____ITEM NO.27: ELECTRICAL CERTIFICATE OF COMPLETION PER SPECIFICATIONS, INCLUDING ALL GROUNDING TESTING, MEGGER READINGS REQUIRED BY SPECIFICATIONS.

❑/_____ITEM NO.28: DO NOT CALL FOR FINAL INSPECTION UNTIL ALL UNITS HAVE HAD MECHANICAL START-UP FORMS, TEST AND BALANCE, AND CONTROLS FULLY INTEGRATED AND SUBMITTED TO ENGINEER AND COMMISSIONING AGENT.

❑/_____ITEM NO.29: CONTRACTOR READINESS FORMS COMPLETE FOR EACH PIECE OF EQUIPMENT: (ATTACHED)

A. MECHANICAL UNITS – AHU, RTU, MAU
B. WATER HEATERS

Sign before requesting Final Inspection:
Signature of Person Completing Readiness Checklist. _____Date_____

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

115 East Main Street Round Rock, Texas 78664

COMMISSIONING • FIELD INVESTIGATIONS

PH: (512) 218-0060 FAX: (512) 218-0077

ROOF TOP UNITS (RTU)
Contractor Readiness Checklist

Roof Top Unit (RTU)

The installing contractor must check and verify all items listed below, prior to calling for a Final RTU inspection. This check list must be completed for all Roof Top Units as part of Final Inspection Readiness. The person performing the check must provide a signed form for each unit. Provide complete signed and dated for each unit prior to calling for final inspection.

- Unit installation:
  - The manufacturer's service and operating clearances have been provided and if free of conduit, piping, ductwork, etc.
  - Unit is level.
  - Hail Guards installed.
  - Unit Curb and Flashing per job details.
  - Roof deck only cut for duct drops, not entire curb dimension.
  - 2 layers of exterior sheathing installed on roof deck inside of curb for sound attenuation.
  - Permanent Label Installed
  - Door Handles installed.
- Drain pan :
  - The float switch is installed, wired to controls and has been tested.
  - Pan has been cleaned of all construction debris.
- Condensate drain:
  - Material is copper.
  - Installed per details with proper trap depth.
  - All cleanouts are installed for easy maintenance.
  - Unions installed per detail
  - Installed with the proper amount of slope.
  - Terminates at a code approved disposal point.
  - The insulation installed and sealed per detail and specification and does not have gaps.
  - Ensure proper air gap at all condensate disposal points.
- Ductwork Items:
  - Ductwork has been connected to the RTU unit as shown in detail.
  - Ductwork insulation ends have been sealed in return air of the RTU.
  - Internal duct insulation 48" past first 90 bend per detail. (unless owner request external)
  - RA internally lined per detail with sheet metal duct liner stops(unless owner request external)
  - Duct Wrap insulation has been terminated as detailed.
  - Duct insulation is continuous under duct smoke detectors.

        - Duct access door on supply air after first 90 per detail.
        - Duct access doors on both sides of turning vanes when installed.
        - The access door in the return air plenum is installed in an easily accessible location for inspection and cleaning. (Access door not required if duct is open for plenum return)
        - If an outside air duct is to be connected to Return Air Duct, it must be downstream from the return air inlet / connection.
        - The first supply branch duct tap must be downstream from the duct/smoke detector.
        - Duct taps no allowed within 48" past elbow.
    - Unit access:
        - Ensure Filter removal access is not blocked.
        - Verify that all access doors can be opened or removed without damaging the insulation vapor barrier, per details, specifications, for all required components including Fire/Smoke dampers.
        - No ductwork, Electrical conduit, Fire Alarm Cable, or Controls Wiring to be located in service access area.
        - Disconnect not installed blocking access door.
        - Maintenance Receptacle operational.
    - Gas
        -
    - Follow ALL associated details
        - Rooftop Unit Curb/Flashing Detail
        - Deep Seal Trap Detail
        - Duct Drop Detail
        - Typical Gas/Condensate Piping Connection Detail

Signature of Person Completing Readiness Checklist. _____Date_____

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street **Round Rock, Texas 78664**

PH: (512) 218-0060 **FAX: (512) 218-0077**

AIR HANDLING UNIT (AHU)
Contractor Readiness Checklist

Air Handling Unit (AHU)

The installing contractor must check and verify all items listed below, prior to calling for a Final AHU inspection. This check list must be completed for all Air Handling Units as part of Final Inspection Readiness. The person performing the check must provide a signed form for each unit. Provide complete signed and dated for each unit prior to calling for final inspection.

- Unit installation:
  - The manufacturer's service and operating clearances have been provided and if free of conduit, piping, ductwork, etc.
  - Spring isolators have been properly sized and installed per the manufacturer's installation instructions. Specifically, all nuts must be field adjusted for proper travel.
  - The refrigerant piping has been installed in a neat workman like manner and does not interfere with required service and operating clearances.
  - Refrigerant piping supported per refrigerant piping detail.
  - Verify unit is installed with positive slope toward condensate drain.
  - Unistrut supporting unit to be installed per detail (long direction of unit)
  - 2" filter rack installed.
- Condensate drain:
  - Installed per details with proper trap depth.
  - All cleanouts are installed for easy maintenance.
  - Installed with the proper amount of slope.
  - Terminates at a code approved disposal point.
  - The insulation is sealed per specification and does not have gaps.
  - Ensure proper air gap at all condensate disposal points.
- Auxiliary Drain pan :
  - Extends beyond air-handling unit as shown / noted in detail.
  - Has the supports installed inside and underneath the pan as shown in detail. (Long direction of pan)
  - The float switch is installed, wired to controls and has been tested.
  - A drain has been installed in Aux Drain Pan and is capped or piped off to the exterior of the building as shown or note on the drawings.
  - Pan has been cleaned of all construction debris.
  - Neoprene isolation tape has been installed between the pan and supports and between the supports and unit as shown in detail.
- Ductwork Items:
  - Ductwork has been connected to the Air Handling unit as shown in detail.

        - Ductwork has been sealed at the Air Handling unit as shown in detail.
        - Duct Wrap insulation has been terminated at the Air Handling unit as detailed.
        - Duct insulation is continuous under duct smoke detectors.
        - The access door in the return air plenum is installed in an easily accessible location for inspection and cleaning. (Access door not required if duct is open for plenum return)
        - If an outside air duct is to be connected to Return Air Duct, it must be downstream from the return air inlet / connection.
        - The first supply branch duct tap must be downstream from the duct/smoke detector.
    - Unit access:
        - Verify that all access doors can be opened or removed without damaging the insulation vapor barrier, per details, specifications, for all required components including Fire/Smoke dampers.
        - Supports do not interfere with the removal of the access doors.
        - Ensure Filter removal access is not blocked.
        - Verify that all access doors can be opened or removed without damaging the insulation vapor barrier.
        - No ductwork, Electrical conduit, Fire Alarm Cable, or Controls Wiring to be located in service access area.
    - Unit Test and Balance completed and ALL deficiencies resolved and provided to Engineer.
    - Equipment Start-up form Completed and provided to Engineer.
    - Controls Integrated and verified operational.
    - Unit Discharges 58 degrees or cooling in ALL speed of cooling, and recorded.

Signature of Person Completing Readiness Checklist. _____Date_____

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street **Round Rock, Texas 78664**

PH: (512) 218-0060 **FAX: (512) 218-0077**

WATER HEATER (WH)
Contractor Readiness Checklist

Water Heater (WH)

The installing contractor must check and verify all items listed below, prior to calling for a Final WH inspection. This check list must be completed for all water heating units as part of Final Inspection Readiness. The person performing the check must provide a signed form for each unit. Provide complete signed and dated for each unit prior to calling for final inspection.

- Unit installation: (per details on plans)
  - The manufacturer's service and operating clearances have been provided and if free of conduit, piping, ductwork, etc.
  - WH has T&P piped off per code.
  - Unions installed on hot and cold water connections above WH for future maintenance.
  - Drain pan installed,
  - WH sits on Unistrut to lift up in drain pan.
  - Drain pan drain line installed.
  - Expansion tank installed, wall mounted or suspended. (not on floor)
  - Check valve, balancing valves, ball valves, and strainers all installed per detail.
  - HW, CW, HWR all piped according to detail.
  - Aquastat installed.
  - Vacuum breaker installed.
  - Housekeeping pad installed when required.
  - Perforated straps are not allowed for supporting of piping or equipment.
- Piping:
  - Insulated with PVC jacketing per specifications.
  - Ends of insulation covered with mastic.
  - The insulation is sealed per specification and does not have gaps.
  - All piping labeled, with correct label spacing.
  - All piping to be installed in a manner to make changeout of WH easy.
  - Valve Tags installed
- Gas WH:
  - Gas pipe with sufficient straight piece to allow water heater or boiler to function properly.
  - Dirt leg installed with cap and not touching ground.
  - Combustion Air vent piping installed per manufacturer installation instructions.
    - For intake length including bends
    - For exhaust length including bends
    - Termination location, including distance from obstructions and parapets.
  - Provide Acid Neutralization Trap for all condensing gas water heaters.

Signature of Person Completing Readiness Checklist. _____Date_____

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Outstanding Items Final Punch Inspection Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE REQUIRED TO BE ADDRESSED AND SIGNED OFF IN WRITING BY CONTRACTOR FOR EACH UNIT OR ROOM AS INDICATED BY INDIVIDUAL ITEMS BELOW. THESE ITEMS MUST BE COMPLETED AND SUBMITTED WITH ANY DEFICIENCIES CORRECT PRIOR TO REQUESTING FINAL MEP INSPECTION.

GENERAL ITEMS:

COMPLETED ( ) / INITIALS

❑/_____ITEM NO.1: ALL MECHANICAL UNITS: PROVIDE CONTRACTOR READINESS CHECKLIST (START-UP FORMS),

- MECHANICAL CONTRACTOR - START-UP REPORTS
- MANUFACTURER START-UP FORM (WHEN REQUIRED)
- MECHANICAL START-UP FORM
- CONTROLS START-UP FORM
- TEST-BALANCE WITH ALL DEFICIENCIES ADDRESSED.
- COMMISSIONING FOR ALL MECHANICAL UNITS AS LISTED IN SPECIFICATION. SCHEDULE OF VALUE LINE ITEM WILL NOT BE PAID UNTIL ALL FORMS FOR ALL EQUIPMENT HAVE BEEN COMPLETED, SUBMITTED AND REVIEWED. PARTIAL PAYMENT WILL NOT BE PROVIDED. SPECIFICATION SECTION 20 00 00.

❑/_____ITEM NO.2: PROVIDE TEST AND BALANCE REPORT WITH ALL DEFICIENCIES ADDRESSED AND WITH DISCHARGE AIR TEMPS IN COOLING MODE PER SPECIFICATIONS.

❑/_____ITEM NO.3: CONFIRM ACCESS DOORS ARE PROVIDED FOR ALL FIRE/SMOKE DAMPERS AND OTHER REQUIRED LOCATIONS, PER DETAILS, SPECIFICATIONS FOR ACCESS TO REQUIRED COMPONENTS. ENSURE ACCESS DOORS ARE PROVIDED IN DUCTWORK AS DECRIBED IN RTU AND AHU DETAILS AT FIRST 90° TURN FOR RTU AND BOTH SUPPLY AND RETURN OF AHU. REFERENCE SPECIFICATION FOR PROPER SIZE AND SPACING.

❑/_____ITEM NO.4: CONFIRM ALL THERMOSTATS CALIBRATED AND ADJUSTED TO + OR – 1 DEGREE ACCURACY. PROVIDE SIGNED FORM FOR ALL SENSORS.

❑/_____ITEM NO.5: CHECK DISCHARGE AIR TEMPERATURE OFF OF ALL COOLING UNITS. (INCLUDE DISCHARGE AIR IN COOLING FOR EACH STAGE OF COOLING, MUST BE 56 DEGREES OR COOLER, REFERENCE START-UP FORMS)

❑/_____ITEM NO.6: CHECK DISCHARGE AIR TEMPERATURE AND HUMIDITY OFF OF ALL MAKEUP/OUTSIDE AIR UNITS. (MUST BE 53 DEGREES OR COOLER OFF COIL) WHEN MAU'S ARE PRESENT ON JOB.

❑/_____ITEM NO.7: LIGHITNG CONTROL TEST DOCUMENTATION : PROVIDE FACTORY START-UP AND PROGRAMMING OF 'NLIGHT' LIGHTING CONTROLS. PROVIDE DOCUMENTATION THAT THIS FACTORY PROGRAMMING HAS OCCURRED.

❑/_____ITEM NO.8: SURGE PROTECTION TEST DOCUMENTATION: PROVIDE DOCUMENTATION THAT MANUFACTURER ONSITE TESTING HAS BEEN COMPLETED FOR SURGE PROTECTION.

❑/_____ITEM NO.9: TRANSFORMER TEST DOCUMENTATION: PROVIDE DOCUMENTATION FOR TRANSFORMERS THAT MANUFACTURER HAS VERIFIED CONNECTIONS AND TESTED USB PORT FUNCTION. WHEN TRANSFORMERS PRESENT ON JOB.

❑/_____ITEM NO.10: VERIFY THAT MECHANICAL CONTROL SYSTEM IS COMPLETE.

- ENSURE THAT ACCESS TO CONTROLS IS CONNECTED AND OPERATIONAL.
- OWNER SCHEDULE HAS BEEN INPUT.
- ALL SEQUENCES OF OPERATION FUNCTION PROPERLY
- ALL CONTROL START-UP FORMS COMPLETED AND SUBMITTED.
- ENGINEER WILL REQUIRE ACCESS TO CONTROL SYSTEM DURING FINAL VISIT. PROVIDE ACCESS CODES AND PASSWORDS TO ENGINEER.

❑/_____ITEM NO.11: ELECTRICAL CERTIFICATE OF COMPLETION PER SPECIFICATIONS, INCLUDING ALL GROUNDING TESTING, MEGGER READINGS REQUIRED BY SPECIFICATIONS.

❑/_____ITEM NO.12: CONTRACTOR READINESS FORMS COMPLETE FOR EACH PIECE OF EQUIPMENT: (ATTACHED)

A. MECHANICAL UNITS – AHU, RTU, MAU

B. WATER HEATERS

❑/_____ITEM NO.13: AS-BUILTS PROVIDED.

❑/_____ITEM NO.14: O&M'S PROVIDED.

❑/_____ITEM NO.14: ALL PREVIOUS ITEMS IN ALL PREVIOUS REPORTS THAT HAVE NOT BEEN FIXED ARE STILL CONSIDERED OUTSTAND AND SHOULD BE FIXED WITH PHOTOGRAPHIC PROOF PROVIDED TO OWNER/ENGINEER/ARCHITECT, PRIOR TO GETTING PAYMENT FOR SUBSTANCIAL COMPLETEION.

Sign before requesting Final Inspection:
Signature of Person Completing Readiness Checklist. _____Date_____

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

SECTION 20 01 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes specific requirements, products, and methods of execution which are typical throughout ALL work of this project. Additional requirements for the specific systems will be found in the sections specifying those systems and supersede these requirements.

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 JOB CONDITIONS

A. Obtain approval from Architect prior to cutting any structural elements or furring members.

B. Structural Interferences: Should structural members prevent the installation of piping, ducting or equipment, notify the Architect before proceeding.

C. Consider minor changes in position of equipment, piping, or ducting, as part of the contract at no additional cost to the Owner.

D. Coordinate with Structural and Architectural work to determine acceptable locations for sleeves and supports which are required but may not be specifically shown on the plans. SCHEDULE INSTALLATION OF SLEEVES AND SPECIAL SUPPORTS IN MANNER TIMELY TO THE WORK OF OTHER CRAFT. Anticipate minor offsets necessary for proper coordination with other work and reroute systems appropriately.

E. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Civil and Electrical Drawings where such drawings affect his work.

1.03 DIMENSION AND FIT

A. Cut materials accurately from measurements taken on the JOB SITE.

B. Do not spring or bend pipe to fit conditions or make up joints.

1.04 INTERFERENCES

A. Interferences between piping and other trades shall be handled by giving precedence to pipelines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed. Failure to follow this precedence resulting in spacial conflicts are the Contractor’s responsibility to remove and put back per plans in the order of precedence listed.

1. Building Lines

2. Structural Members

3. Soil and Drain Piping

4. Vent Piping

5. Refrigerant Piping

6. Supply, Return, O/A Ductwork

7. Exhaust Ductwork

8. Chilled and Hot Water Piping

9. Domestic Hot and Cold-Water Piping

10. Natural Gas Piping

11. Electrical Conduit

12. Fire Protection Piping

1.05 SERVICEABILITY OF PRODUCTS

A. Furnish all products to provide the proper orientation of serviceable components to access space provided.

B. Coordinate installation of piping, ductwork, equipment, coils, system components, and other products to allow proper service of all items requiring periodic maintenance or replacement.

C. **Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.**

1.06 ACCESSIBILITY OF PRODUCTS

A. Arrange all work to provide permanent, convenient, and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

B. Provide access doors in ceilings, walls, floors, etc., for access to traps, valves, dampers, automatic devices, and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.07 ROUTING

A. Route all pipelines and ductwork parallel with building lines, and as high as possible, except where under ground or shown otherwise on the plan.

B. Route piping and ducts to clear all doors, windows and other openings, and to avoid all other pipes and ducts, light fixtures, and similar products.

C. Conceal all pipes and ducts where routed through finished areas, unless authorized by Architect or otherwise indicated on plans.

PART 2 - PRODUCTS

2.01 MATERIAL PRODUCTS

A. Provide all products new, unused, and undamaged, of standard manufacture, and of latest design and best quality. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

B. When a manufacturer's name appears in these specifications or schedule, it is not to be construed that the manufacturer's material does not have to meet the full requirements of the specifications or that his standard catalogue item will be acceptable.

C. All equipment installed on this project shall have local representation, local factory authorized service and local stock of repair parts.

D. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25, and a smoke developed index of not more than 50, when tested in accordance with ASTM E 84.

2.02 Where more than one type of material (i.e., cast iron or PVC) is specified, the Contractor may choose one type; however, he must state which type of material he proposes to use in his submittal. ONLY ONE TYPE OF MATERIAL MAY BE USED IN A SPECIFIC PIPING SYSTEM, UNLESS SPECIFICALLY NOTED OTHERWISE. (I.E. WHEN DIFFERENT SIZES OF THE SAME TYPE SYSTEM REQUIRE DIFFERENT MATERIALS PER SPECIFICATIONS.)

2.03 PIPE AND FITTINGS

A. Steel Pipe: **All steel piping and fittings are to be domestically manufactured (USA).**

1. **PROVIDE DOCUMENTATION IN SUBMITTAL STATING LOCATION OF MANUFACTURING.**

2. Threaded: Schedule 40, ASTM A53 grade B or ASTM A120, American Standard pipe thread. Pipe 2" and under to be made up with threaded fittings.

3. Welded: Schedule 40 black, ASTM A53 grade B or ASTM A120, ANSI B16 butt weld fittings of type and wall thickness to suit pipe. Weld-O-Lets and Thread-O-Lets may be used on pipe 2-1/2" and larger where branch is a minimum of two pipe sizes smaller than main. Pipe 2-1/2" and over to be made up with welded fittings. Pipe 2” and under to be made up with threaded fittings.

4. Grooved Pipe: Schedule 40 ASTM A120 or ASTM A53 grade. Standard cut or rolled groove to coupling manufacturer's specifications. Do not use in systems exceeding 200° F. operating temperature.

a. Couplings: Standard weight with gasket selected by manufacturer for service intended.

b. Fittings: Full flow malleable iron, ductile iron or steel.

c. Submit calculations of expansion allowance of joints and obtain approval prior to eliminating any special expansion compensators, swing joints, flexible connections, or vibration isolators.

d. Manufacturers: Victaulic, Gruvlok or Apollo.

5. Press fit: Use Viega Mega Press or equal by Apollo.

B. Copper pipe:

1. Type "K" or "L" hard drawn copper with wrought copper fittings with openings machined to accurate capillary fit for the pipe. Pipe to conform to Standard Specifications for copper water tube. Type 'M' may only be used for A/C condensate drain lines.

2. Use "lead free" (0.00% lead content) solder for all domestic water piping. Submittal on the product to be used must include this information. Lead free solder to conform to ASTM B 32 and flux to conform to ASTM B 813. Soldered joints must be done in accordance with ASTM B 828. Lead free shall mean a chemical composition equal to or less than 0.2 percent lead.

3. Press fit joints using Viega, Apollo or equal press fit fittings.

4. Solder joints using 50/50 lead tin solder for systems operating below 180° F.

5. Solder joints using 430 silver solder for systems operating at 180° F. or above.

C. Domestic Copper Pipe (2" and larger): (Contractor Option)

1. Copper tubing systems from two inches (2") through six inches (6") shall be installed using mechanical pipe couplings of a bolted type with a central cavity design pressure-responsive gasket along with grooved end copper fittings.

2. All copper tubing shall be prepared in accordance with the manufacturer's published specifications.

3. Couplings - Coupling for copper shall consist of cast ductile iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design, with nuts and bolts to secure unit together.

a. Housings - Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) with a copper alkyd enamel paint coating.

b. Gasket - Gaskets shall be molded of synthetic rubber in a central cavity, pressure-responsive configuration conforming to the copper tube size (CTS) outside diameter and coupling housing, of elastomers having properties as designated in ASTM D-2000.

c. Water Service - Gaskets supplied for water services from -30° F to +230° F shall be a Grade "E" EPDM compound, with copper color code, molded of materials conforming to ASTM D-2000, designation 2CA615A15B44F17Z, recommended for hot water service within the specified temperature range.

4. Flanged Connections: Shall be engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components; installer to supply standard flange bolts. Flange casting shall be as in 3, a. above with a corresponding gasket as in 3, b.

5. Fittings - Fittings shall be full flow copper fittings with grooves designed to accept grooved end couplings.

    a. Standard fittings shall be two-inch (2") through four-inch (4") copper per ASTM B-75 alloy C12200; five-inch (5") through six-inch (6") bronze sand castings per ASTM B-584-87 copper alloy CDA 844 (81-3-7-9).

6. Butterfly Valves – Lug style, grooved end butterfly valves are to be rated for bi-directional dead-end service to the full working pressure of the valve with the down stream flange removed.

    a. 2 ½-6" valves shall have either lever lock handles or gear operators. Valves in 2 ½" or 3" sizes may have two-position handle as per service requirements and manufacturer's recommendations.

        1) Valve housing shall be bronze per CDA-836 (85-5-5-5).

        2) Disc shall be aluminum bronze or ductile iron.

        3) Operator bracket shall be steel-black enamel coated.

        4) Operator - Two (2) position detent or manual lever lock shall be steel-black enamel coated.

        5) Seat to be molded to the body of the valve for bi-directional dead-end service

7. Tube Preparation: Copper tube shall be ASTM B-88 (drawn tubing) and prepared in accordance with the latest published manufacturer's specifications, as applicable. Pressure ratings and end loads for roll grooved copper tubing are based upon test on copper tube prepared in accordance with manufacturer's specifications using manufacturer's approved rolled grooving tool for grooving copper tube.

8. Assembly: Couplings, fittings, adapters and tubing shall be assembled in accordance with the latest published instructions from the manufacturer for the particular product installed.

9. Reference hanger spacing in specification. In addition, use the following recommendations for support installation:

    a. Copper tubing joined with grooved type couplings requires support to carry the weight of tubing and equipment. The support or hanging method must be such as to eliminate undue stresses on joints, tubing and other components.

    b. The support system for mechanical grooved type tubing couplings must consider some of the special requirements of these couplings.

D. Compressed Air Piping:

1. Piping to be Type K hard drawn copper pipe.

2. Use capped tees at each joint facing up to allow for future connections. All connections to be made with tees facing up.

3. Slope all piping to drain. Provide drain leg at each low point with ball valve at bottom of drain leg for draining system. Drain leg to be approximately 7'-6" A.F.F. (verify in field).

4. Install Metal-Flex flexible connector near compressor outlet equal to Amber/Booth type SS-PM.

2.04 VALVES

A. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 125 psig steam or 150 psig W.O.G. All valves on insulated lines to have extended handles to allow operation without disturbing insulation seal.

B. Manufacturer: Nibco, KITZ, Jenkins, Milwaukee, Stockham, Apollo or other recognized manufacturer of equal reliability.

C. Gate Valves, 2½" and Larger: Iron body, bronze trim, rising stem, flanged.

D. Globe Valve 2" and Smaller: Teflon disc, bronze body, bronze trim.

E. Ball Valves 3" and Smaller: Brass or bronze body, virgin TFE seat rings, blow-out proof stem, reinforced thrust washer, ¼ turn full open/full close, FULL PORT, CSA-ULFM approval.

F. Globe Valve 2½" and Larger: Iron body, bronze trim, Buna-N disc, flanged, bronze disc hot water, Buna-N disc cold water.

G. Swing Check Valves 2" and Smaller: Bronze body, horizontal swing, Y-pattern, renewable disc.

H. Swing Check Valves 2½" and Larger: Iron body, horizontal swing, bolted bonnet, renewable seat and disc, flanged, non-slam type.

I. **Butterfly Valves: Reference Section 2.03, C. above.**

J. Drain Valves: Hose end gate valve or gate valves with hose connection. Do not use sillcocks in lieu of drain valves.

K. Valves Specified Elsewhere: Provide special valves such as motor operated valves, relief valves, temperature regulating valves, etc., as specified under the individual system or as indicated on the drawings.

L. USE FULL PORT BALL VALVES RATED FOR SERVICE INTENDED FOR ALL ISOLATION VALVES THREE INCHES (3") AND SMALLER.

2.05 BALANCING VALVES

A. Provide balancing valves for all cooling and heating flows and at all pump discharge lines. Provide balancing valves for all potable hot/tempered water recirculation systems and at TMV's as required by manufacturer's written instructions.

B. Valves sized for maximum 1-pound pressure drop at design flow with valve wide open. Submit schedule of balancing valves indicating sizes, flow ranges and pressure drop curves.

C. Valves, rated at not less than 150 psi, furnished with three self-lubricating bronze or teflon-coated stainless-steel bushings with shaft seals at each bushing; seals to be hard back resilient type and shall be field replaceable; discs shall be bronze, aluminum-bronze, or semi-steel with welded nickel edge.

D. Valves 4" and smaller insulated with removable foam polyurethane Dry Cap. Series 400.

E. Valve 2½" through 6" shall be lever operated. Butterfly valves, lug body indicating locking type with adjustable memory stop, may be used at Contractor's option at each location where gate valves or globe valve is indicated on water line 2½" and larger.

F. On valves 2" and smaller, use Flow Set balancing valves system consisting of: 300 lb. rate flow measuring bronze body ball valve with integral venturi and temperature and pressure taps; flow setting 300 lb. butterfly valve assembly with stainless steel disc and Viton seats dual-core temperature/pressure test port and external lockable memory stop. Furnish valves with insulation sleeve for ease of access to temperature/pressure ports and to allow adjustments of valve handles without removing insulation. Manufacturer: FlowSet by Olympic Valve, Inc. At the Contractor's option, use Presso B-Plus balancing valves with extension handle and extension P/T plugs.

G. Manufacturers: DeZurik, Olympic Valve, Inc., Jenkins, Nibco, B & G, Hammond, Presso, Apollo or approved equal.

2.06 UNIONS

A. Provide unions adjacent to all tanks and equipment and where required for disconnect and maintenance of equipment.

B. Union for Steel Pipe: Ground joint malleable iron.

C. Union for Copper Pipe: All brass.

D. Union Between Dissimilar Metals: Dielectric Union designed and advertised to be unaffected by heat, cold or fluid in pipe. EPCO or approved equal.

2.07 MISCELLANEOUS

A. Escutcheons: Nickel or chrome plate with screws or springs for holding plate in position.

B. Automatic Air Vents: Hoffman #79, Marsh or equal.

C. Gaskets: Gaskets 1/16-inch thick for all pipe sizes 10 inches and smaller, and 1/8-inch thick for all pipe sizes 12 inches and larger. Gaskets to be ring type between raised face flanges and full-face type between flat face flanges with punched bolt holes and pipe opening. Gasket material shall be suitable for the service intended and shall be installed as

recommended by the manufacturer. Manufacturer: Crane, John-Manville, or equal.

D. Strainers: Cast iron or bronze body basket or wye type strainers provided with ½" valved drain and a ¼" air vent cock, unless the strainer design is devoid of air pockets. Strainers shall have removable cylindrical or conical screens of nickel, copper, or brass and suitable flanges or tappings to connect with the piping they serve. Strainers 2½" and larger shall be provided with flanged covers. The free area of each screen shall not be less than three (3) times the area of the strainer inlet and shall be suitable for the service intended. For chilled and hot water loop systems provide Metraflex LPD-MAG y-strainer with magnet and blow down valve. Manufacturers: Metraflex, Crane, McAlear, Sarco or Armstrong.

2.08 MECHANICAL SUPPORTING DEVICES

A. General:

1. Securely fasten all mechanical work to the structure to prevent hazard to human life and limb, and to prevent damage to products of construction under all conditions of operation.

B. Pipe Supports:

1. Single Pipes:

a. Support all horizontal runs of steel, copper pipe under 2" and all cast-iron soil pipe on suitable hangers spaced not more than 5 feet on centers. Support all steel, and copper piping 2" and larger not more than 10 feet on centers. Support all PVC piping not more than 4 feet on center. Support piping in a manner to prevent binding, undue swing, and the transmission of vibration to the structure.

b. Support single pipes from clevis hangers equal to Anvil fig. 260. Install hangers for insulated piping outside the insulation using high density section of insulation and sheet metal shield or saddle. Provide copper plated hangers in contact with copper pipe.

2. Trapeze Hangers: Where pipes are clustered, parallel, and in same plane, they may be supported by trapeze hangers. Provide rods and angle-irons sized to suit load imposed. Minimum channel length to be six inches (6"); maximum rod spacing to be twenty-four inches (24") on center. Piping to be securely attached to trapeze hangers. Provide sheetmetal shield or saddle for all insulated piping running horizontally.

3. Piping on Walls: Secure with hook-plates, clips or fabricated steel brackets.

4. Supports from Steel Beams and Similar Construction: Use appropriate beam clamps.

5. Provide inserts for poured concrete and expansion bolts for pre-cast slabs.

6. Guide and anchor piping where necessary to control expansion and contraction. Provide supports and hangers with non-corrosive and rust-resistant finish. Galvanize or plate hanger rods after threading. Hangers other than those specified not permitted. **USE ONLY GALVANIZED HANGERS AND HANGER RODS FOR ALL PIPING IN CRAWL SPACE.**

7. Provide inserts for poured concrete and expansion bolts for pre-cast slabs. Use HiltiDrop-in Anchor or Kwik Bolt II Stud Anchor System. Verify allowable place of anchors with Structural Engineer.

8. Provide pipe supports according to the following schedule:

PIPE SIZE - INCHES	ROD SIZE – INCHES
½" through 2"	3/8"
2½" through 3"	1/2"
4" through 6"	5/8"
8" through 12"	3/4"

9. Manufacturers: Anvil International, C&P, Fee and Mason, Elcen or SuperStrut.

C. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for piping 2-1/2" and smaller. For piping over 2-1/2", up to and including 8", use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All pipe stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Walk board to be a minimum of 3" larger on each side than support. Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 6"). Provide supports for piping under 2" at six feet on center. Provide supports for piping 2" and over at eight feet on center. **PIPE PROP will not be acceptable.**

D. Ductwork Support: Refer to Section 23 30 00-Air Distribution.

E. Inserts: Provide all inserts required for installation of horizontal piping. In poured concrete provide wrought steel or malleable iron and adjustable type. Where expansion bolts are necessary to secure piping or equipment, use malleable iron type with expansion case, to be inserted by drilling concrete. Power driven inserts not permitted for supporting piping to ceiling.

F. Miscellaneous Iron and Steel:

1. Provide all steel supports and hangers to support all equipment or materials unless noted otherwise.

2. All work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets and framework shall be properly sized and rigidly constructed in a manner to withstand anticipated loads.

3. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be performed by experienced metal-working mechanics. Members shall be straight and true and accurately fitted.

4. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other Trades.

5. Members shall be generally welded, except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled and certified.

6. All shop fabricated iron and steel work shall be cleaned and dried and given two (2) coats of weatherproof primer paint on all surfaces and in all openings and crevices.

2.09 ACCESS DOORS

A. Doors shall be Karp, Inland Steel Products, Milcor, Miami or Walsh-Hannon, constructed of steel with primer coat of rust inhibitive paint, and continuous piano hinge. Doors shall be key operated with flush operated cylinders, keyed alike. Key lock system shall be coordinated with the Owner and shall be approved by the Architect. Provide six (6) keys of type used for access panels for Owner's use. Obtain receipt of key delivery and submit to Architect for record.

1. Suspended Lath and Plaster Ceilings - Style: "M" with 16-gauge frame, 14-gauge panel.

2. Masonry Non-Rated Walls - Style: "M" with 16-gauge frame, 14-gauge panel.

3. Masonry Fire Rated Walls - Fire rated with UL, ½ hour "B" rating, 16-gauge frame, 20-gauge sandwich type insulated panel.

4. For access doors larger than 16" in either direction, provide two (2) locksets.

PART 3 - EXECUTION

3.01 EQUIPMENT MOUNTING

A. Provide equipment concrete pads, treated support runners, roof curb supports, mounting accessories, supports, hanger expansion joints, adapters and any other appurtenances to adapt fixtures and equipment supplied to the conditions of use.

B. Provide vibration eliminators as specified (if not specified elsewhere use vibration eliminators recommended by equipment manufacturer) at all pieces of equipment subject to vibration. (Exception; curb mounted equipment does not require vibration isolator rails except when specifically scheduled).

C. Independently support piping and ductwork at equipment so that no weight is supported by the equipment.

D. Securely fasten fixtures and equipment to the building structure in accordance with manufacturer's recommendation.

E. Provide steel base plates for floor mounted fixtures and equipment to distribute the weight so that the floor load is not more than 100 lbs. psf, unless special structural reinforcement is submitted for approval.

F. At wall attached fixtures and equipment weighing less than 50 pounds, provide backing plates of at least 1/8 x 10-inch sheet metal or 2 x 10-inch fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.

G. Electrical conduit shall not be hung from equipment or plumbing piping.

H. When project is in a wind zone that would require equipment on roof or ground to be secured by additional means required by building code for Wind, Tornado, Hurricane maps, secure per manufacture installation details and if addition direction is required, then coordinate with structural engineer for additional details and methods.

3.02 SLEEVES

A. Provide sleeves as required where pipes pass through walls, floors, or ceilings. Make sleeves as follows:

1. In non-fire rated bearing walls, foundations, masonry or concrete walls and floors, use schedule 40 black steel pipe.

2. In non-rated construction, use minimum 20-gauge galvanized sheetmetal.

3. In fire rated walls, floors and assemblies, install sleeves as required by UL System Number.

B. In non-fire rated areas install sleeves flush with surfaces. In mechanical rooms or any wet floor where seepage may occur, install sleeve 1 inch above floor and caulk. Caulk both sides of penetration using UL listed one-part firestop synthetic elastomer sealant, flexible at normal working temperatures, having smoke developed 50, fuel contributed 50, and flame spread 25 rating. Install thickness per manufacturer's recommendation. Manufacturer: Dow Corning FireStop 2000 Sealant, Flame Stop V, 3M: CP-25.

C. Waterproof all piping and sleeves through building exterior skin, including walls, roofs and interior floor penetrations to prevent leakage. Coordinate with the Architect on caulk material to use at exterior.

D. Size sleeves for cold piping to allow for continuous insulation through sleeve.

3.03 SEALING AND FIREPROOFING

A. **SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.**

1. Only materials tested in the specific UL System Number may be used.

a. Wrap Strip (UL System No. WL 5001): Nominal 1/4" thick by 2" wide intumescent elastomeric material. Manufacturer: 3M Type FS-195.

1) Use one (1) wrap strip for up to one-inch (1") thickness insulation.

2) Use two (2) wrap strips for 1-1/2" inch and larger thickness insulation.

b. Caulk Manufacturer:

1) 3M Type CP-25 WB+ for all assemblies requiring 3M caulk.

2) For WL3045 and 3046 use Hilti FS611A Sealant.

c. Steel Sleeve (Stud Wall) (UL System 1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum 2" lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus 1" such that, when installed, the ends of the sleeve will project approximately ½" beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with pipe) to be 2 to 2-1/2" larger than the outside diameter of pipe, such that when the steel sleeve is installed, a 1 to 1-1/4" annular space will be present between the steel sleeve and the pipe around the entire circumference of the pipe. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.

d. Steel Sleeve (Concrete or Block Wall): For cables, provide sleeve cast in floor/wall or mortared into CMU wall; optional sleeve for UL System No. CAJ1175.

e. Forming Material: Minimum one-inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.

2. Wire/Cables:

a. For Gypsum Frame Wall (Single Cable): Fireproof per UL System No. WL3001. Opening for cable to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" inch larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).

b. For Gypsum Frame Wall (Multiple Cables): Use UL System No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.

c. For Concrete Walls/Floors or CMU Walls (Single or Multiple Cables): Fireproof per UL System No. CAJ3030. Cables to be a minimum ten percent (10%), maximum thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one-inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.

3. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies.

4. Materials used in firestop systems shall be installed in accordance with the manufacturer's instructions, provided with materials for specific UL System Number.

5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.

B. Manufacturers: 3M, Metacaulk, Hilti, BioFireshield, STI or equal.

C. In non-rated walls identified for sound insulation, provide 1/2" space between pipe and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.

D. **Final condition to prevent passage of fire, smoke, noxious gas and water.**

E. For non-rated mechanical/electrical room walls: Seal all piping and ductwork passing through walls, floors and ceilings with 3M caulk, Type CP-25+.

F. Submit UL numbers and details for type of penetrations and materials to be used. All penetrations in fire rated walls, floors and ceilings must be installed per a UL listed detail specified for the application.

G. **Seal both sides of all floor penetrations into crawl space on both sides to prevent air and water migration.**

3.04 WATERPROOFING AND COUNTERFLASHING

A. Provide and install all counterflashing of all conduit, pipe or duct and equipment which penetrates roofs, walls and other weather barrier surfaces. **Metal Roofing Contractor shall provide and install all curbs and counter flashing for all metal roof penetrations. Verify detail with Architect before installation.**

B. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at contractor’s expense, to Architect's satisfaction.

C. Conduits, pipes or ducts passing through slabs shall have the sleeve extended above floors to retain any water and the space between the conduit, pipe or duct and sleeve caulked with lead wool. The top shall be sealed with lead and the bottom shall be sealed with monolastic caulking compound.

D. All waterproofing, flashing and counterflashing shall be provided and installed by the Roofing Contractor and shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect.

E. Slope all ducts to wall louvers to drain toward louvers. Provide continuous sleeve thru wall and seal all joints.

F. **All piping and conduit penetrations through exterior walls shall be sealed on both side of drain plane and at exterior finished wall surface to prevent moisture intrusion.**

3.05 LABELING AND TAGGING

A. Tag all valves with minimum 1/16" thick heat resistant laminated dark plastic labels engraved with readily legible white lettering 1/4" high indicating fluid in pipe and a “V” (valve) number (e.g. V-22). Securely fasten to the valve stem or bonnet with beaded chain. Provide an

aluminum valve chart and frame with glass cover for typewritten valve chart. Install where directed. Coordinate valve numbers with mechanical contractor to avoid duplication. Refer to Section 20 00 00, and Manuals.

B. Label all equipment with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/2" high and fastened in place with rivets, screws or adhesive backing. Example "WH-1, AHU-1, etc." If items are not specifically listed on the schedules, consult the Architect concerning designation to use. Refer to Section 20 00 00. Label all equipment served by emergency electrical panels with red labels.

C. Label all thermostats/sensors with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/4" high and fastened in place with rivets, screws or adhesive backing. Label is to correspond to rooftop and/or air-handling units.

D. Provide access panel markers (minimum 1/16" thick laminated plastic type with engraved lettering) to indicate ceiling tile to be used for access for all A/C equipment, terminal units and plumbing shut-off valves. Use light green for plumbing and light blue for A/C equipment. Label to be attached to ceiling grid with rivets, screws or adhesive backing. Example, “AHU-3A” access. Plastic Label shall not be larger than the surface it is affixed to. IE. Shall not overhang grid or flange.

E. Manufacturer: Seton Pipe Marking Products, MSI (Marketing Services, Inc.) or equal.

3.06 TYPICAL PIPING

A. Provide insulating couplings or unions to prevent electrolysis between dissimilar metals when use of dissimilar metals cannot be avoided in one system.

B. Close all openings in pipes with appropriate caps, plugs, or covers during storage and progress of the work to preclude introduction of contaminants.

C. Arrange systems and locate valves so that either entire system or separate sections thereof may be drained for service. All service valves located no more than 24 inches above the ceiling and normally accessible from an 8-foot ladder.

D. Provide valves and unions adjacent to all tanks, batteries of plumbing fixtures and equipment, for disconnect purposes. Install all valves with stems vertical wherever possible, and in no case with stems below the horizontal.

E. Ream ends of all pipe to full diameter.

F. Provide pipe anchors, swing joints, and expansion compensators as required to control the expansion of pipelines.

G. Reduce pipe sizes using reducing tees or reducing fittings. Bushings not permitted except on tanks and similar equipment.

H. Provide escutcheons on all pipes passing through walls, floors, and ceilings in finished areas where piping is in counters, closets or cabinets, and subject to view when doors are open. Cover the pipe sleeve and secure plate in position.

I. Install hangers at each change in direction, and within 2 feet at each elbow or tee. This requirement is mandatory.

J. Pipe hooks, wire, chains or perforated metal shall not be used for pipe supports.

K. Insulate hangers for copper pipe from piping with at least two layers of 12 mil Polyken 826 corrosion control tape.

L. Install piping not to interfere with removal of equipment, ducts and devices or block access to door or access openings.

M. Piping serving plumbing fixtures and equipment shall be securely supported near the point where pipes penetrate the finished wall.

N. Test all piping in accordance with accepted trade standards if not specified elsewhere.

3.07 THREADED PIPE

A. Cut all threads true and of depth to make up properly without leaks.

B. Make connections to show at least two threads and not more than four threads when tight.

C. Make up joints with Teflon tape only as recommended by tape manufacturer, or as specified in specific piping sections.

3.08 AUTOMATIC (MANUAL) AIR VENTS

A. Install at highest point of chilled and hot water system, at chilled and hot water coils and at points necessary to relieve air in piping. Provide shut-off valve to facilitate maintenance of air vent.

B. Route 1/4" copper line from discharge of air vent to floor drain in mechanical room. Slope to drain.

3.09 PAINTING AND CODING

A. Ductwork and Piping: Prime and paint all exposed angle braces, hanger rods or straps, damper rods, and quadrants with one coat aluminum paint after removing scale and rust. Prime and paint ductwork and piping exposed in finished rooms to match room finish. Prime and paint all black iron piping located outdoors or otherwise exposed to weather. Coordinate painting and color with Architectural paint specified elsewhere. All painting done by persons regularly employed at and skilled in that trade.

B. Grilles, Registers, Etc.: Furnish all grilles, registers, etc., other than extruded aluminum or plastic, with prime coat paint by manufacturer. Furnish all ceiling grilles, registers and diffusers with factory applied baked enamel to match ceiling tile. Paint all ductwork and/or conduit visible through registers, grilles and other openings with one coat of flat black paint to a point four feet (4') from opening on straight duct or around bend, whichever applies.

C. Pipe Coding and Labeling:

1. Identify piping with pressure-sensitive coded pipe marker. Secure both ends of marker with pressure sensitive tape with flow arrows(on both sides of label) on roll to indicate flow direction.

a. Max 20’ spacing.

b. Within 24” of disappearing or emerging from wall.

c. Taps to fixtures with 36” or more before entering wall.

d. Taps to equipment – within 24” of equipment connection. (when not concealed in a wall.

e. Color code pipe markers and arrows indicating the liquid and/or use of the pipe. IE: markers for HW and CW must be different color.

2. Code piping to the following schedule: (SUBMIT ALTERNATE CODING)

Cold Water	CW
Hot Water	HW
Hot Water Return	HWR
Gas	FUEL GAS
Sprinkler	SPKR
Condensate	Condensate

3. Manufacturers: Seton Pipe Marking Products, MSI or equal.

END OF SECTION

SECTION 20 02 00 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall breakdown the final Schedule of Values to be used for Pay Application into the following minimum categories.

B. **All categories shall have appropriate material and labor breakdown.**

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

D. All Equipment Start-Up line items submitted for payment will be zero dollars until 100% of Start-Up forms are completed, deficiencies corrected and submitted to Engineer in writing. Partial payment of these items will not be done. All forms must include signature and phone number of person completing. Partially completed form will not be accepted. This applies to Mechanical, Controls, Test and Balance, Contractor Equipment Start-Up line items. Reference below and Equipment Start-up specification for additional information.

1.02 SCHEDULE OF VALUES

A. Site Wastewater

B. Site Water

C. Plumbing Rough-in Below Slab

D. Plumbing Rough-in Above Slab

E. Rainleader Piping System Below Slab

F. Rainleader Piping System Above Slab

G. Insulation (water and rainleader piping)

H. Acid Waste/Vent Piping

I. Plumbing Fixture/Trim (this is to include setting fixtures and water and wastewater final connections)

J. Water Heater

K. Mechanical A/C Equipment

L. Ductwork

M. Ductwork Insulation

N. Diffusers and Trim Out

O. Exhaust Systems

P. Gas Piping

Q. Condensate Piping

R. Balancing and Testing

S. Testing/Sterilization (Water/Wastewater)

T. Controls

U. Controls Graphics – Submittal

V. Completed Controls Equipment Start-Up forms

W. Owner Training Controls

X. Labeling Equipment

Y. Record Drawings/O & M Manuals -

Z. Completed Mechanical Equipment Start-Up Form

AA. Completed Test and Balance (minimum 10% of Test and Balance contract)

BB. Commissioning Reports Completed

CC. Mandatory Pre-Construction Meeting (DDC Contractor, Mechanical Contractor, Test and Balance Representative) ($25,000 per Contractor)

1.03 Schedule of Values must be approved before Monthly Pay Application will be approved.

END OF SECTION

SECTION 20 07 00 - INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products and methods of execution which relate to the insulation of ducts, pipes and other surfaces of the mechanical installation.

2. Insulation is provided for the following purposes:

a. Energy conservation

b. Control of condensation

c. Safety of operating personnel

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. Acoustical Lining Insulation Summary

1. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of air duct systems of sheet metal lined with fibrous glass duct liner, in accordance with applicable project drawings and specifications, subject to terms and conditions of the contract:

2. All air duct systems operating at internal air velocities not exceeding rated duct liner limitations as listed below and internal air temperature not exceeding 250°F (121°C).

3. Duct liner products shall conform to the requirements of ASTM C1071. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

4. The manufacturer’s product identification shall appear on the air stream surface.

5. Duct liner adhesive shall conform to the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

6. The finished duct system shall meet the requirements of NFPA 90A and 90B.

7. Duct dimensions shown on the plans are finished inside dimensions.

8. Fabrication and installation shall conform to the requirements of the latest edition of the North American Insulation Manufacturers Association's *Fibrous Glass Duct Liner Standard* (hereinafter referred to as NAIMA FGDLS) or the Sheet Metal and Air Conditioning Contractors National Association *HVAC Duct Construction Standards - Metal and Flexible* (hereinafter referred to as SMACNA HVAC DCS) or the manufacturer's recommendations.

D. References

1. American Society of Testing and Materials (ASTM)
    a. ASTM C1071
    b. ASTM C916
    c. ASTM G21
    d. ASTM G22
    e. ASTM C423
    f. ASTM C518
2. National Fire Protection Association (NFPA)
    a. NFPA 90A
    b. NFPA 90B
    c. NFPA 259
3. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
    a. HVAC Duct Construction Standards Metal and Flexible (HVAC DCS)
4. North American Insulation Manufacturers Association (NAIMA)
    a. Fibrous Glass Duct Liner Standard (FGDLS)
5. International Nonwovens & Disposables Association (INDA)
    a. IST 80.6

E. Delivery, Storage and Handling

1. Deliver all materials and/or fabricated insulated duct sections and fittings to the job site and store in a safe, dry place.
2. Protect materials from dust, dirt, moisture, and physical abuse before and during installation, startup and commissioning. Wet or contaminated duct liner shall be replaced.

PART 2 - PRODUCTS

2.01 FIRE RATING OF MATERIALS

A. Provide all insulation products used above ground in buildings with burning characteristics not to exceed the following ratings according to NFPA 255-1972 “Method of Test of Surface Burning Characteristics of Building Materials”: Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

B. Insulation specified for use underground and above ground away from the building, might have other burning characteristics. Use such products only where specifically required.

2.02 INSULATION

A. TYPE "A": Pre-molded Fiberglass Piping Insulation:

1. Jacketed Type:

a. Thermal conductivity K = 0.24 at 100° F. mean temperature.

b. Factory applied kraft-reinforced vapor barrier flame retardant all service jacket and tape, with permeability rating - 0.02 perms. All service jacket with polymer film exterior surface that is smooth, durable, cleanable, wrinkle resistant, resists water staining and that does not support mold or mildew growth.

c. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.

d. Fitting insulated with pre-cut insulation inserts covered with PVC fitting cover properly vapor sealed.

e. Manufacturer: Owens-Corning Fiberglass SSL II with ASJ Max or equal product by: Knauf or Manville with WMP-ASJ jacket.

2. Secondary Jacket (This goes on over properly sealed standard WMP-ASJ jacketing) All piping run within spaces such as Water Heater Rooms, Mechanical Rooms, Janitor Closets and unconditioned spaces such as Crawl Spaces or ventilated attic spaces):

a. PVC jacket Shall be used in <u>all</u> mechanical/boiler rooms for all insulated piping to within two inches (2") of interior wall surface of mechanical/boiler rooms. This includes all satellite mechanical rooms containing air handlers.

b. One (1) piece “hinged” construction.

c. **Entire piping system in mechanical rooms is to be covered with high-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish with 25/50 rating.** Properly seal all joints. Follow manufacturers written installation instructions.

d. ALL Fittings to be insulated with pre-cut insulation inserts and are to be covered with PVC fitting cover.

e. All piping in Unconditioned spaces other than mechanical rooms are to be wrapped with mold resistant Polyguard ZERO-PERM vapor barrier membrane. Properly seal all joints. Follow manufacturers written installation instructions.

B. TYPE "B": Cellular Piping Insulation:

1. Thermal conductivity K = .27 @ 75° F. mean temperature.

2. Elastomeric thermal insulation with permeability rating of .17 perms and Microban antimicrobial protection against mold growth.

3. Temperature range from -40° F to 220° F.

4. Insulation to meet 25/50 requirements for use in return air plenums.

5. Wall thickness as listed in Part 3 of this Section for size and use of piping.

6. Install without slit when possible. All slits in insulation to be smooth. Insulation installed with jagged edges will be removed and replaced at no cost to Owner.

7. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

8. When used on VRF and minisplit heat pumps use Armacell Armaflex UT pipe insulation.

9. Manufacturers: Armacell Armaflex Pipe Insulation or equal by Aerocell or K-Flex. All insulation located outside must be Armacell Armaflex Shield with UV-Resistant durable protective jacket. If piping is serving VRF or minisplit heat pump provide Armaflex UT with additional coating of WB UV protection.

C. TYPE “C”: Blanket Type Duct Wrap Fiberglass Insulation:

1. **The Contractor may use a 3/4, 1 or 1-1/2-pound density product with a minimum installed R-value of 6.0 if ductwork is within building insulation envelope or minimum R-value of 8.0 if installed outside of building insulation envelope.** Density, thickness and installed R-value to be clearly indicated on submittal.

2. Fiberglass duct wrap insulation is to have a factory FSK or FRK facing which acts as the vapor barrier. Maximum permeability rating is 0.02 perms.

3. Use only labeled Type UL181AP Aluminum Foil Tape a minimum of 3" wide and 7.4 mils thick “Venture Tape #1525CW” or “Shurtape #AF-982”). Maintain a complete vapor barrier throughout all ductwork insulation applications. Use spreader to completely seal tape to all joints or tears in vapor barrier, surface must be clean prior to installation.

4. Certainteed SoftTouch Duct Wrap with FSK facing or equal. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

5. Manufacturers: Knauf, Schuller/Manville, Certainteed or Owens-Corning (**NO MANSON**) .

D. TYPE "F": FIRE RESISTIVE DUCT WRAP

1. Work of this section includes labor, material and equipment to provide 2-hour, fire resistive rated grease or air duct enclosure as a shaft alternative and a method for providing zero-inch clearances around commercial kitchen grease duct exhaust systems to combustible materials.

2. Lightweight flexible refractory ceramic fiber blanket encapsulated with aluminum foil scrim. Nominal 1 ½" thick, 9 PCF.

3. UL Classified, double layer, fireproof, flexible, 2 hr. rated enclosed assembly with offset seams and stainless-steel bands as required to meet 2-hour requirement.

4. Zero clearance to combustibles.

5. Use in combination with 3M Fire Barrier, 2000+ silicone sealant.

6. 3M, UL system V-17. Install as listed.

7. Manufacturer: 3M FireMaster Fast Wrap or equal by Unifrax Fyrewrap or Pyroscrat as approved by local AHJ.

E. TYPE "G": Cellular Elastomeric Foam Duct Liner:

1. Thermal conductivity K = .27 @ 75° F. mean temperature.

2. Elastomeric thermal insulation with permeability rating of .17 perms.

3. Temperature range from -40° F to 220° F.

4. Insulation to meet 25/50 requirements for use in return air plenums.

5. Minimum R-value of 6.0 for one and one-half (1-1/2") thickness. Installed R-value to be a minimum of 6.0 inside building envelope. Minimum R-8 for ducts located outside the building insulation envelope.

6. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

7. Manufacturers: Armacell Armaflex AP or Armacell Coilflex elastomeric foam duct liner with Microban.

F. TYPE "H": Pre-molded Owens/Corning FoamGlas Piping Insulation:

1. Thermal conductivity K = .27 @ 75° F. mean temperature.

2. Elastomeric thermal insulation with permeability rating of .17 perms.

3. Temperature range from -450° F to 900° F.

4. Jacket Type: Factory applied PITTSEAL CF Jacketing, with permeability rating - 0.02 perms. All service jacket with polymer film exterior surface that is smooth, durable, cleanable, wrinkle resistant, resists water staining and that does not support mold or mildew growth.

5. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.

6. Fitting insulated with pre-cut insulation inserts covered with PVC fitting cover properly vapor sealed.

7. Manufacturer: Owens-Corning Foamglas with Pittseal CF Jacketing or equal product by: Knauf or Manville with equal jacket.

8. Secondary Jacket (This goes on over properly sealed standard jacketing) All piping run within Janitor Closets, Water Heater Rooms, Riser Rooms, Mechanical Rooms and Crawl Spaces or ventilated attic spaces where PVC is allowed):

   a. 25/50 rated PVC jacket Shall be used in <u>all</u> areas listed above for all insulated piping to within two inches (2") of interior wall surface of all areas listed above.

   b. One (1) piece “hinged” construction.

   c. **Entire piping system in areas listed in 2. is to be covered with high-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.** Properly seal all joints. Follow manufacturers written installation instructions.

   d. ALL Fittings to be insulated with pre-cut insulation sections.

   e. All piping in Unconditioned spaces other than those listed in 2. or in plenum space are to be wrapped with mold resistant Polyguard ZERO-PERM vapor barrier membrane. Properly seal all joints. Follow manufacturers written installation instructions with white side out.

G. TYPE "J": Pre-molded Polyguard PolyPhen Piping Insulation:

1. Jacket Type:

   a. Thermal conductivity K = 0.24 at 100° F. mean temperature.

   b. Factory or field applied PolyGuard Zero Perm Jacketing, with permeability rating - 0.00 perms. with exterior surface that is smooth, durable, cleanable, wrinkle resistant, resists water staining and that does not support mold or mildew growth.

   c. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.

   d. Fitting insulated with pre-cut insulation inserts covered with PolyGuard Zero Perm Jacketing and PVC fitting cover properly vapor sealed.

e. Manufacturer: PolyGuard or equal product by: Knauf or Manville with equal jacket.

2. Secondary Jacket (This goes on over properly sealed standard jacketing) All piping run within Janitor Closets, Water Heater Rooms, Riser Rooms, Mechanical Rooms and Crawl Spaces or ventilated attic spaces where PVC is allowed):

a. 25/50 rated PVC jacket Shall be used in all areas listed above for all insulated piping to within two inches (2") of interior wall surface of all areas listed above.

b. One (1) piece “hinged” construction.

c. **Entire piping system in areas listed in 2. is to be covered with high-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.** Properly seal all joints. Follow manufacturers written installation instructions.

d. ALL Fittings to be insulated with pre-cut insulation sections.

e. All piping in interior Unconditioned spaces other than those listed in 2. or in plenum space are to be wrapped with mold resistant Polyguard ZERO-PERM vapor barrier membrane. Properly seal all joints. Follow manufacturers written installation instructions with white side out.

2.02 SOUND CONTROL

A. Lined Duct: (As noted only)

1. **Provide acoustically lined duct to attenuate and control the transfer of airborne sound and as duct insulation only when specifically indicated.**

2. Lining: Flexible fiberglass blanket type mat faced insulation with durable surface coating, bonded with thermosetting resin. Maximum flame spread index; 25. Maximum smoke developed index; 50. **Lining to have anti-microbial coating.** Minimum R-value of 6.0 for one and one-half (1-1/2") thickness. Installed R-value to be a minimum of 6.0. **1.5" thick, R-6 lining equal to CertainTeed ToughGard R-EP or ToughGard2 Textile Duct Liner.** R-8 for ducts located outside the building insulation envelope. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

3. Air Friction Correction Factor 1.12 at 500 fpm or less.

4. Minimum sound absorption co-efficients as follows:

Thickness	Frequency					
	125	250	500	1000	2000	4000
1-1/2"	.17	.53	.87	.99	1.00	.95

5. All duct dimensions shown on drawings are net clear inside dimensions with duct liner. Install liner in compliance with requirements of NFPA 90A.

6. Manufacturers: Shuller, CertainTeed, Knauf or Owens-Corning.

7. All duct liner to be provided with tough abrasion resistant interior air side finish and antimicrobial coating.

2.03 INSULATED FITTING COVERS AND JACKETING

A. High-impact, 25/50 rated UV-resistant polyvinyl chloride jacketing with gloss white finish.

B. Pre-cut curled jacketing, 30 mil. thickness. Sized to snugly fit pipe diameter with thickness of insulation specified.

C. Joints and seams sealed with Perma-Weld Adhesive to form a complete vapor barrier for chilled water and domestic cold-water systems. Use tack and tape for heating water and domestic hot water systems. Installation of adhesives, tacks and tape shall be per manufacturer's recommendations. Submit installation instructions with submittal of materials.

D. Fitting Covers: Covers shall be pre-formed for fitting shape.

E. Manufacturer: Manville Zeston 2000 or Proto.

2.04 CANVAS JACKETING

A. Insulating Lagging Canvas: 8oz./sq. ft. minimum, 28 threads per inch minimum, Osnaberg or equal.

B. Lagging Adhesive: Plastic synthetic resin emulsion adhesive; watertight, mildew resistant, fire retardant; Miracle LA69, Borden Aerosol or equal. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

2.05 METAL OR VINALUM JACKETING

A. Material shall be minimum .016" thick aluminum jacket or vinalum .020" thick aluminum faced PVC jacket with integral factory applied vapor barrier.

B. Elbows, fitting and valves shall be metal preformed fitting covers (no gores acceptable). Valves made from .020 metal. All valves ends and where insulation reduces, shall have Pittsburgh seams.

1. All straight-line metal to be Z-locked jacket held in place with 3/4" wide aluminum bands at nine inches (9") on center with wing seals.

C. All joints and seams shall be watertight with Childers CP-76 OR Foster 95-44.

D. Manufacturer: "Strap-On" Childer Cawed Systems or equal.

2.06 COATINGS

A. All coating to bear the UL label. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

B. On cold or dual service lines, use vapor barrier type coatings.

2.07 METAL SHIELDS (SADDLES)

A. Metal Shields curved to fit up to midpoint of the insulated pipe.

B. Metal shields shall be 16 gauge, twelve inches (12") long for pipes up to two inches (2"), 14 gauge, eighteen inches (18") long for piping 2-1/2" to 4", twenty four inches (24") long for piping 5" to 6", 14 gauge, thirty inches (30") long for piping over 6".

C. Provide rigid insulation for entire length of saddle plus 4" (2" at each end) to properly support piping. All piping support to be on exterior of insulation.

2.08 PRE-INSULATED PIPES

A. Pre-insulated with minimum 60 mil. PVC jacket manufactured by Southwest Insul-Pipe.

B. Insulation shall be foam-in-place polyurethane minimum two inches (2") thick.

C. All fittings, joints, and valves shall be reformed half section type with insulation.

D. Piping to be heat traced.

E. Use waterproof cawed material for all fittings and joints.

F. Mastics shall be outdoor type.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION AND WORKING CONDITIONS

A. Apply all insulation, fitting covers, mastics and sealants per manufacturer's recommendations.

B. Do not apply insulation materials until all surfaces to be covered are clean and dry and all foreign materials such as rust, dirt, etc., are removed.

C. Keep insulation clean and dry during installation and during the application of any finish.

D. Do not install the insulation on pipe fittings, and pipe joints until the piping is tested and approved.

E. Do not apply under conditions of excessive humidity or at temperatures below 50° F or above 100° F.

3.02 TECHNIQUE FOR APPLICATION TO PIPES

A. Close longitudinal joints of pipe insulation firmly and butt insulation sections firmly together.

B. Neatly and smoothly adhere all laps and butt strips. Adhere three inch (3") wide self-sealing butt joint strips over end joints.

C. Replace all insulation having loose joints or laps. Sloppy work will not be acceptable and such work shall be removed and re-applied.

D. Provide ½" over the thickness of insulation specified at all insulated piping in outside walls.

E. Where insulation with a vapor barrier terminates, it shall be sealed with “Ductmate Protack”. Ends shall not be left raw.

F. On water piping use sheet metal shields outside the insulation at hanger locations. In addition, provide:

1. A molded vegetable cork or foam glass insert not less than twelve inches (12") long of same thickness and contour as insulation between support shield and piping and under the finish jacket.

2. Heavy density insulation minimum six (6) pounds per cubic foot under entire length of metal shield.

G. Where piping and fittings are installed out of doors, provide vapor barrier jacket, cover with metal or vinalum jacket with seams located on bottom side of horizontal piping.

3.03 TECHNIQUE FOR APPLICATION TO PIPE FITTINGS, UNIONS AND VALVES

A. On insulated piping with vapor barrier, insulate fittings, unions, valves and flanges including Victaulic and Gustin-Bacon to the same thickness as the pipe insulation.

B. Any of the following methods of insulation is acceptable:

1. PVC Snap Form Fitting Covers: Wrap all valves and fittings with precut fiberglass insulation wraparound inserts. Brush vapor barrier mastic on adjoining section of pipe insulation and on overlapping edges of jacket and throat seam before applying preformed fitting. Secure cover with stainless steel tacks. Tape joints with pressure sensitive vapor barrier tape.

2. Blanket Wrap: Wrap the fitting with compressed glass fiber blanket. Wire the blanket securely in place, then cover with a smooth layer of insulating/finishing cement. Cover with glass mesh tape, adhering it with an adhesive coating.

3. Fabricated Segments: Cut mitered segments from pipe insulation that has the same wall thickness as adjacent pipe insulation, to form a cover which will fit snugly around the fitting. Wire the segments firmly in place and seal the joints with insulating/finishing cement. Apply adhesive coating and wrap with glass mesh tape, then apply another layer of the same coating over the whole assembly.

4. Cement: Apply insulating finishing cement, molding it to the contour of the fitting. When area is large, apply an under layer of cement, wrap this with glass mesh tape, then apply an outer layer of cement. If the insulation is not concealed, the exposed surface of insulating/ finishing cement is to have a final glass mesh tape wrap embedded in adhesive.

C. In each of the listed methods, to protect the insulation against contact damage, apply an adhesive coating when the cement is completely dry and hard, then wrap with glass mesh tape. Apply another coating of adhesive over the whole assembly.

3.04 TECHNIQUE FOR APPLICATION TO DUCTWORK

A. Impaling Over Pins: Install all insulation with edges tightly butted. Impale insulation on pins welded to the duct and secure with speed clips. Trim off pins close to speed clip. Space pins as required to hold insulation firmly against duct surface, but not less than one pin per square foot. Seal all joints and speed clips with glass fabric set in adhesive. Provide metal angle at corners to protect edges of insulation.

B. Other Method of Securement: If the welded pin method is impossible, secure the insulation to the duct with “Ductmate Protack” or Childers CP-127 or Foster 85-60 adhesive. Cover the entire surface of the metal with adhesive when applying to the underside of horizontal ducts. Application to top and sides may be in strips with a minimum of 50% coverage. Additionally, secure insulation with No. 16 galvanized wire on not more than twelve-inch (12") centers. Provide metal angle at corners to protect edges of insulation. Seal joints as above. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. Where external insulations terminate, seal insulation to ductwork with Childers CP-35 or Foster 30-65 with 3" glass fiber reinforcing mesh.

D. Impale rigid insulation board over pins. Provide two layers of glass cloth and four layers of weatherproof vapor barrier adhesive coating. Install .040 thick lock-formable aluminum jacket over sealed insulation. All joints are to be 1” standing seams. The top of the aluminum jacket is to slope a minimum of 1” in 12” to sides to prevent collection of water. Install tapered insulation under sloped top for support of aluminum jacket. Provide a minimum of 1” flange out at connection point to mechanical equipment and building to ensure that water does not get under jacket. Provide counterflashing that is appropriate for building material type. Coordinate with Architect to ensure a watertight connection to building.

3.05 EXAMINATION (LINED DUCTWORK)

A. Verify that the duct liner products are installed in accordance with project drawings, duct liner operating performance parameters and limitations, and provisions of NAIMA FGDLS or SMACNA HVAC DCS or manufacturer’s recommendations.

3.06 INSTALLATION (LINED DUCTWORK)

A. As noted only, Auditorium, Music Practice Room, Band Hall, Air Transfers, Areas specifically noted on plans.

B. All portions of duct designated to receive duct liner shall be completely covered with duct liner. All joints shall be neatly butted and there shall be no interruptions or gaps. Duct liner shall be installed with the Printed air stream surface treatment exposed to the air stream.

C. Duct liner shall be adhered to the sheet metal with 90% (minimum) coverage of adhesive complying with the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

D. All transverse edges that are not to receive sheet metal nosing shall be coated. Longitudinal joints shall occur at the corners of ducts. If duct size and standard duct liner product dimensions make exposed longitudinal joints necessary, such joints shall be coated with adhesive designated for duct liner application and which meets the requirements of

ASTM C 916. Such joints shall be additionally secured with mechanical fasteners in accordance with NAIMA FGDLS, or SMACNA HVAC DCS as if they were transverse joints.

E. Duct liner shall be additionally secured with mechanical fasteners complying with the requirements NAIMA FGDLS or SMACNA HVAC DCS and of the correct type for the duct liner being installed. Fasteners may be either weld-secured or impact-driven and shall be installed perpendicular to the duct surface. Mechanical fasteners shall not compress the insulation more than 1/8" (3 mm) based on nominal insulation thickness. Fastener spacing with respect to interior duct dimensions shall be in accordance with NAIMA FGDLS or SMACNA HVAC DCS. Fastener heads or washers shall have a minimum area of 0.75 in^2 (484 mm^2), with beveled or cupped edges to prevent their cutting into the duct liner.

F. Where air velocities exceed 4000 fpm (20.3 m/sec), metal nosing (either channel or "zee" profile) shall be installed on upstream edges of liner duct sections.

G. Metal nosing shall be securely installed over transverse liner edges facing the airstream at fan discharge and at any point where lined duct is preceded by unlined duct.

H. Duct liner in roll form shall be folded and compressed in the corners of rectangular duct sections, or shall be cut and fit to assure a lapped, compressed corner joint

I. Duct liner in sheet form shall be cut and fit to assure tight, over-lapped corner joints. Top pieces of liner shall be supported at the edges by the side pieces

J. Any damage to the air stream surface must be repaired by coating the damaged area with adhesive or coating designed for duct liner application. Adhesive or coating shall meet requirements of ASTMC916.

3.07 FIELD QUALITY CONTROL (LINED DUCTWORK)

A. Upon completion of installation of lined duct and before HVAC system start-up, visually inspect the ductwork and verify that duct liner has been correctly installed. Confirm that the duct system is free from construction debris.

B. After the lined duct system is completely installed and ready for service, conduct a final inspection of the entire system. This inspection should include, at minimum, the following steps:

1. Check all registers, grilles, and diffusers to ensure that they are clean and free from construction debris.

2. Check all filters in accordance with their manufacturer's instructions. Use specified grade of filters at all times that system is operating.

3. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork.

4. Turn the HVAC system on and allow it to run until steady state operation is reached.

5. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.

6. Check to ensure that air delivery performance meets all requirements and complies with SMACNA leakage specifications.

3.08 PROTECTION (LINED DUCTWORK)

A. Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.

B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.09 COLD AND RAIN LEADER PIPING INSULATION

A. Insulate piping for domestic cold water, rain leaders, from primary and overflow roof drains, floor drains receiving condensate and piping leaving said floor drains using one-inch (1") Type "A" Insulation.

B. Provide a complete vapor barrier throughout the entire system. Use only vapor barrier adhesives and coatings. Stapling of jacket not permitted. Penetrations in vapor barrier jacket, joints, and seams sealed vapor proof with Childers CP-35 or Foster 30-65 (white) mastic. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. Cover ends of insulation sections with an adhesive coating at intervals of not more than twenty feet (20'). Insulate accessories, valves, flanges, etc.

D. Cover insulation on fittings with spiral-wrapped glass mesh tape. Finish with a vapor barrier coating applied approximately 1/16" thick.

E. Insulate ALL horizontal and vertical runs for primary and overflow roof drain rain leader piping from bottom of roof deck to include roof drain body, to the exit of the building.

F. Insulate all cold-water piping above ceiling to point where piping turns down into chase. When piping turns down into exterior walls, piping in exterior walls must be insulated.

3.10 HOT & TEMPERED PIPING INSULATION

A. Insulate domestic hot and tempered water and circulating lines using one inch (1") Type "A" insulation one inch (1") thickness for ½" to one inch (1") piping, 1-1/2" thickness for 1-1/4" to two inch (2") piping and two inch (2") thickness for 2-1/2" to six inch (6") piping.

B. Staples may be used to seal jacket.

C. Insulate unions, valves and flanges in boiler room only for piping over 140° F. Insulate with same method used for cold pipe fittings, except vapor barrier mastic is not required.

D. Do not insulate valves, flanges, and unions for domestic hot water piping systems below 140° F., but bevel and seal ends of insulation at such locations.

E. Insulate hot water expansion tank and air separators with one-inch (1") sheet type "B" insulation.

3.11 SPECIAL PIPING INSULATION REQUIREMENTS

A. Crawl Space Piping – Ventilated Attics – Piping Located Exterior to Building

1. All Cold Water, Chilled Water, Waste Carrying Condensate, SHALL ALL USE TYPE 'H' FOAM GLASS TYPE INSULATION with PVC jacket. Minimum 2" or thicker as required by manufacturer and temperature difference to prevent condensation. All other sealing specifications apply.

2. ALL water carrying piping, SHALL ALL USE TYPE 'H' FOAM GLASS TYPE INSULATION with PVC jacket. Minimum 2" or thicker as required by manufacturer and temperature difference to prevent condensation. All other sealing specifications apply.

3. Insulate p-trap of all floor drains and deep seal traps that receive condensate below first floor when there is a crawlspace or basement. Insulate piping down to main tie in point. Insulate with 2" thick Type "H" Insulation.

4. Roof Mounted Condensate piping (excluded from this requirement).

B. Insulate buried domestic hot and cold-water lines under building with one-inch (1") Type "B" Insulation. Bond joints using an adhesive; apply surface treatment as recommended by insulation manufacturer, taping not permitted. Set in sand bed and cover with minimum five inches (5") sand. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. **Insulate all refrigerant piping for heat pump and heat recovery systems and suction lines only for all other systems with Type "B" Insulation:** ½" thickness for piping up to 1" and 3/4" thickness for piping larger than one inch (1"), apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 Adhesive BLV LOW VOC. All insulation located outside must be Armacell Armaflex Shield with UV-Resistant durable protective jacket. If piping is serving VRF or minisplit heat pump, provide Armaflex UT with additional coating of WB UV protection. Refrigerant piping outdoors to be insulated and covered with an aluminum jacket with seams located on bottom side of horizontal piping. Jacketing to be neatly installed. No tape is allowed. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

D. Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).

E. Insulate p-trap of all floor drains above the first floor and deep seal traps that receive condensate. Insulate piping down to main tie in point. Insulate with 1" thick Type "B" Insulation or 1" type "A" insulation

3.12 DUCT INSULATION REQUIREMENTS

A. Insulate Ducts as Follows:

1. Thickness and Type:

a. Exhaust Air and Outside Air Exhaust Ducts: Externally wrap with Type “C” Insulation; insulate from roof deck/wall exterior back three feet (3') into space. (R-6)

b. Rooftop Units: Internally line rooftop unit supply and return air drops past first ninety-degree elbow for a minimum of six feet (6’), reference Specification Section 20 07 00, 2.03, Sound Control for Liner. Provide access door in duct risers for access and cleaning. Minimum size 18 x 18. (Exception: Rooftop unit serving kitchen is to have the supply air drop internally lined and the return air drop externally wrapped with Type “C” Insulation.). R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

c. Supply Air: Externally wrapped with Type “C” Insulation, unless specifically noted otherwise. Internally lined per Section 20 07 00, where noted, first 48” past first 90-degree fitting on RTU and 48” from AHU. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

d. Return Air: Externally wrapped with Type “C” Insulation, unless specifically noted otherwise. Internally lined per Section 20 07 00, where noted, RTU duct drop insulated per detail, AHU return air box within 48” of unit. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building envelope.

e. Outside Air: Supply ducts externally wrapped with Type “C” Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

f. Relief Air: Externally wrap with Type “C” insulation when run through unconditioned spaced, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

g. Air Devices: Externally wrap backs of all supply, return and exhaust air devices including square to round adapters and boots with Type “C” Insulation. Properly seal all edges. Use R-8 insulation for air devices with backs outside of building insulation envelope and R-6 insulation when backs of air devices are located inside building insulation envelope.

h. Grease Rated Kitchen Exhaust: Shall be installed in one (1) hour enclosure with minimum three inches (3") clear, maximum twelve inches (12") clear, reference Architectural. Coordinate access doors with enclosure. As an option to installing grease rated exhaust duct in a one (1) hour enclosure, insulate with Type “F” insulation installed to meet manufacturer’s written instruction for this application.

i. Kitchen Supply: Type “C” or Type “D” Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

j. Exterior Ductwork: R-8 Type “E” and/or duct liner insulation.

k. Special circumstance as noted: R-6 or R-8 Type “G” duct liner insulation.

3.13 CONDENSATE PIPING INSULATION

A. Condensate piping to be insulated with Type “B” Insulation 1/2" thick. Entire condensate system to be insulated when run inside building or in crawlspace/basement. When copper or steel pipe is used outdoors insulate only to a point 2’ downstream of trap unless piping turns down into building to termination point. If it does insulate the whole run of piping.

1. Apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 BLV LOW VOC Adhesive. No tape will be allowed. Auxiliary condensate not required to be insulated. Protect all insulation on piping outside with two (2) coats of “WH” Armaflex Finish Coating for weather protection. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

END OF SECTION

SECTION 21 00 00 - FIRE PROTECTION

PART 1 - DESCRIPTION

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products and methods of execution relating to fire protection for the project.

2. Temporary occupancy permits, or partial occupancy require alarm and life safety systems to be fully operational. Expedite installation and complete life safety requirements for temporary occupancy.

B. Scope: Provide a system of fire protection, complete in every detail and in perfect operating order, in accordance with the contract documents and applicable codes and standards to protect the areas noted, including all piping, valves, backflow preventers, sprinkler heads, heat shields, fire department connections, alarm valves, flow switches, hangers, supports, pertinent accessories, etc. for a complete turnkey job.

1. Remodel or Expansion Scope:

a. Expand existing fire sprinkler system to the remainder of the building.

b. All Additions Provide complete new system.

c. Phasing : Phasing of the sprinkler system installation will be required. All phasing shall be coordinated with General Contractor, they are in charge of all phasing. General Contractor will provide separate plan as applicable to communicate phasing. Summer work, during school year work, start and stop dates etc….

d. Coordinate all ceiling work with General Contractor.

2. This is a performance specification. Construction and installation drawings and hydraulic calculations shall be prepared according to standard practice, by a Sprinkler designer under the supervision of a State of Texas licensed RME-G or a Professional Engineer. Change in installation necessary due to lack of coordination with other trades shall be made without additional cost to the Owner. Verify final location of all exposed piping with the Architect.

3. Coordinate final location of Fire Department Connection (FDC) with local Fire Marshall. Provide all piping and materials required for installation of FDC.

4. Provide Class I standpipe system in stairways and at locations if required in accordance with IFC and NFPA 14. Fire hose threads used in connection with the standpipe systems shall be approved and shall be compatible with fire department hose threads. Final location of fire department hose connections shall be approved by Fire Marshal and coordinated with Architect.

5. Provide Class III standpipes in stages greater than 1,000 square feet as required by IFC and NFPA 14. Fire hose threads used in connection with the standpipe systems shall be approved and shall be compatible with fire department hose threads. Final location of fire department hose connections shall be approved by Fire Marshal and coordinated with Architect.

6. Sprinkler Contractor to begin work at flanged stub 12" A.F.F. provided by site utility contractor in Fire Riser Room. Coordinate final size and stub location with site utility contractor.

7. Provide AMES Fire and Waterworks Series 1BR In-Building Riser, single piece, stainless steel, with all NFPA 24 and code required thrust blocking/rod anchoring, coordinate with soil conditions. When expansive soils are present provide 'EBAA Iron INC. "FLEX-TEND FORCE BALANCED FLEXIBLE EXPANSION JOINT". Size to match fire line size. If soil conditions are unknown at time of bid, include in base price and provide deductive alternate to be removed from scope when soil conditions are known. Installation to be by Fire Protection Contractor or Site Utility Contractor with 'SCRU' License. Installation to be per NFPA 24 "Standard for Installation of Private Fire Main.

C. Provide the following type fire protection in the areas noted:

1. Provide a wet and/or dry pipe sprinkler system (light hazard pipe schedule) to protect the entire building as required. Hazard type shall be as required by FM Global, NFPA-13, International Fire Code and as required by the Owner's Insuring Agency.

2. Provide a dry pipe system in any areas subject to freezing.

3. Remodel areas receiving new ceilings shall have new heads as defined in this specification and treated as new construction to match all additions. Existing pendant heads shall not be reused on new ceilings.

D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

E. Provide floor sink in each sprinkler riser room.

F. Submit shop drawings for the fire sprinkler system to the local Fire Department for review prior to installation.

1.02 Provide all fire protection in accordance with the minimum provisions of the latest approved edition of the following codes and standards.

A. NFPA 13 - Latest approved edition, Sprinkler Systems.

B. Latest approved edition of the International Fire Code.

C. Latest approved local ordinances and amendments.

1.03 SUBMITTALS AND APPROVALS

A. Review and Approvals Required:

1. Obtain written review and approval of the entire fire protection system design and arrangement from the following authority:

a. State Fire Marshall (Approval)

b. Owner's Insuring Authority (Approval)

c. Architect (Approval)

d. Mechanical Engineer (Review)

2. Provide construction drawings, calculations, details and all other data required by the above authority for approval.

B. Submittals:

1. Provide complete fire protection systems construction drawings and calculations for the entire project.

2. Obtain and verify the high and low static water pressure and the residual pressure at full flow at the point of connection to the water utility systems or at a nearby point acceptable to the approval authority. Obtain data from flow tests or system network design calculations of reliability acceptable to the approval authority. Use this data in flow calculations and include it with submittal of calculations.

3. Include the following on the construction drawings:

a. Location of water source, routing and size of supply piping.

b. Location of key gate valves.

c. Detector check valves.

d. Fire department connections.

e. All necessary controlling equipment.

f. Location of flow alarm valves.

g. All distribution system piping and outlets.

h. Reflected ceiling plan showing proposed location of sprinkler heads and other outlets.

i. Interference control between work of other trades.

j. Indicate connection points for Fire Alarm Contractor and provide letter indicating coordination has been done with Fire Alarm Contractor.

k. Provide 1/4" shop drawing of sprinkler entrance and valve assemblies to ensure adequate space.

4. Submit six copies of fire protection drawings reviewed and approved by the Administrative Authority to the Architect for further approval. Include all correspondence with the Administrative Authority.

5. Obtain approval of Architect prior to ordering, fabricating or installing any part of the system. Head locations are subject to this review and approval.

1.04 COORDINATION REQUIRED

A. Check all dimensions indicated on the Architectural or structural drawings and verify dimensions at the site before fabricating any portion of the system. Any discrepancies in piping and head locations resulting from failure to so check shall be corrected expeditiously to provide proper coordination of all trades.

B. Coordinate work with that of other crafts to ensure that adequate space is provided for all work, including requirements for accessibility and serviceability. Locate sprinkler heads to avoid conflict with light fixtures and other installed equipment, and center location of piping and heads in field to accomplish these requirements for coordination.

C. Coordinate with Mechanical Shop Drawings to avoid ducts from RTU's and other main runs.

D. Do not install any piping over electric rooms, electric equipment, MDF/IDF/Technology rooms or racks. Only piping serving electric/technology rooms may enter electric rooms and should enter over doorway.

1.05 FINAL INSPECTION AND APPROVAL

A. After installation is complete, obtain inspection and letter of approval of system stating that sprinkler system complies with all requirements for a fully sprinklered building.

1.06 ACCEPTABLE SUPPLIERS

A. Furnish the services of a qualified and approved fire protection subcontractor to provide the work of this specification section. Unless otherwise noted, this is substantially a "performance" specification.

B. Subcontractor minimum qualifications include:

1. Maintain a complete engineering, sales, installation and service organization that has operated within the Austin/San Antonio area for at least three years prior to bid date of this project.

2. Maintain a complete stock of replacement parts.

3. Remain on 24-hour call for emergency service.

4. Demonstrate satisfactory completion of three projects of similar size and scope. Provide references if required.

5. Bids by wholesalers, Contractors or any firm whose principle business is not that of manufacturing and/or installing fire protection systems are not acceptable.

1.07 MAINTENANCE INFORMATION AND INSTRUCTION

A. Reference Section 20 00 00.

B. Include instruction charts describing operation and proper maintenance of fire protection devices.

C. Include publication entitled: “Care and Maintenance of Sprinkler Systems”, NFPA No. 13-latest approved edition.

PART 2 - PRODUCTS

2.01 General: Provide only products which are a standard product of a manufacturer regularly engaged in the fire protection application where they are used.

2.02 Labels and Approvals for Products: All products UL or FM listed, labeled and specifically approved for the fire protection application where they are used.

2.03 PIPE AND FITTINGS

A. Water Systems:

1. Piping system materials shall be currently recognized by NFPA 13 and must be listed for the intended service by UL or FM. Furnish steel pipe and fittings of domestic manufacturers only.

2.04 VALVES

A. All valves UL listed and labeled and specifically approved for the fire protection application where they are used. Minimum working pressure 175 psi non-shock cold water.

2.05 SPRINKLER HEADS; FINISHED AREAS

A. General: Heads of temperature rating required by NFPA 13, suitable for system type. **USE FLEXIBLE TYPE SPRINKLER HEAD CONNECTION ONLY.**

B. Concealed Quick Response Type: With coverplate and spring-loaded clips, color as approved by Architect. Reliable G4QR concealed with cover to be used in all ceilings unless otherwise noted.

C. Quick Response Dry Pendant Type: For use in freeze applications. Reliable Model G3FR.

D. Institutional Heads: For cell and other secure type areas. Flush style type to conceal operating parts except for sensor, Conical Escutcheon Assembly attached to sprinkler body with tamper resistant fasteners. Pendent or side wall mount as applicable. Use side wall in cell areas. Reliable Model ZX-OR-IWST.

E. Pendant Type: For the Gym and Maintenance Areas use Quick Response Type, Reliable Model F1FR. Use sprinkler guards on sprinkler heads in Gym Area.

F. Manufacturers: Chemetron, Reliable, Grinnell or approved equal.

2.06 SPRINKLER HEADS; UNFINISHED AREAS

A. General: Heads of temperature rating required by NFPA 13; plain finish suitable for system type.

B. Type: Fusible link, equal to Reliable Model A.

C. Manufacturers: Reliable, Grinnell, approved equal.

2.07 FIRE DEPARTMENT CONNECTION (FDC)

A. FDC: Cast brass body and trim having individual 2-1/2" double female snoot inlets with rigid end NPT with pin lug hose thread swivels, plugs, and chain; outlet size as required; exposed parts polished brass (chrome-plated); horizontal flush mounting; Potter Roemer 5020 Series or approved equal. Coordinate final requirements and locations of FDC with Fire Marshal.

B. Provide appropriate lettering on escutcheon plate, to identify connection.

C. Provide hose threads to match the threads of the local fire department.

D. Provide Knox Caps per Fire Department requirements.

2.08 SPRINKLER ALARM VALVE ASSEMBLY

A. Provide sprinkler alarm valve assemblies, appropriate to the system, complete with all trimmings and accessories for proper alarm initiation and interface with fire alarm system. Include inlet and discharge pressure gauges, main drain and inspectors test connection.

B. Alarm Gong: Provide a 10" diameter water powered alarm bell, confirm location with Architect.

2.09 WATER FLOW DETECTORS

A. Provide flow switches or water flow detectors as required. Provide switches compatible with fire alarm system.

B. Electrical connection by Electrical Contractor. Coordinate location and quantity with Electrical Contractor.

2.10 VALVE TAMPER SWITCHES

A. Furnish UL listed and FM approved, series NGV supervisory switch for OS & Y valve installation with two single pole, double throw microswitches. The mechanism shall be contained in a red baked enamel, weatherproof housing and shall incorporate the necessary facilities for attachment to valves. The switch mechanism shall be compatible with the fire alarm system. The entire installed assembly shall be tamperproof and arranged to cause switch operation if the housing cover is removed or if the unit is removed from its mounting. Install supervisory switches and furnish all wire and conduit required from supervisory switch to the alarm panel. Furnish a set of additional alarm contacts for additional supervisory capability.

B. Manufacturers: Potter Electric Signal Co., Model OSYS-B or approved equal.

C. Electrical connection by Electrical Contractor. Coordinate location and quantity with Electrical Contractor.

2.11 INSPECTORS TEST CONNECTIONS

A. Provide inspectors test connections for complete system testing and as required for final approval by inspecting authority.

B. Chemoplate all portions of pipe and fittings exposed outside building; provide chrome-plated set screw escutcheon.

2.12 DRY SYSTEM

A. Provide Nitrogen Generator System for all Dry Zones.

1. Basis of Design – South Tek (www.southteksystems.com)

a. FPS – xxx (sized for system)

b. Quick Check Purity Manifold (sized for system)

c. Provide with Auto Purge

d. Provide appropriately sized air compressor for system to have 30 min max charge time.

B. Provide UL approved low air pressure alarm switches on each dry system, compatible with fire alarm system.

C. Electrical connection is described in Division 26-28 work. Coordinate location and quantity with Electrical Contractor.

2.13 BACKFLOW PREVENTER

A. Provide UL and FM approved reduced pressure zone (RPZ) double check backflow flow preventer equal to Ames Silver Bullet style inside building at fire entry point. Provide shop drawing indicating space requirements. Pipe RPZ relief to nearest floor sink.

2.14 FIRE PUMP SYSTEMS

A. Furnish and install a complete fire pump system complete with pump, driver, controller, jockey pump accessories. The pumping unit shall be listed by Underwriter's Laboratories, Inc. and fully approved by the Associated Factory Mutual Fire Insurance Companies. The pumping unit shall meet all requirements of the National Fire Protection Associated Pamphlet No. 20. The fire pump shall be designed to deliver a required G.P.M. and pressure to meet NFPA flow requirements for building. Contractor to verify city pressures.

B. The driver shall be an open drip-proof (or T.E.F.C.), ball bearing type, AC, induction, squirrel cage motor, wound for 480 volts, 3 phase, 50 hertz. The motor shall be of such capacity that 115% of the full-load ampere rating shall not be exceeded at any condition of pump load for U.L. listed fire pump systems and 110% of full-load for F.M. approved fire pump systems. Locked rotor current shall not exceed the values specified in NFPA Pamphlet No. 20.

C. Pump and motor shall be mounted on a common baseplate of steel with drip rim. Pump and motor shall be checked for alignment after the pump base has been installed and grouted in place.

D. All pumps where the suction pressure is expected to average 40 P.S.I. or below, shall be provided with lantern ring connected to the pressure side of the pump by a cored passage in the parting flange of the pump. Stuffing boxes shall be equipped with split bronze packing glands designed for easy removal for packing inspection and maintenance.

E. The fire pump service rated motor control shall be U.L. listed and F.M. approved. It shall be completely assembled, wired and tested by the control manufacturer before shipment from the factory, and shall be labeled “Fire Pump Controller”. Fire pump controller shall have over current protection to handle locked rotor amp of fire pump. The controller shall be located as close as practical and within sight of the motor. The controller shall be so located or protected that it will not be injured by water escaping from the pump or connections. The controller shall be of the combined manual and automatic across-the-line type, and shall be complete with disconnect switch – externally operable, quick break type, circuit breaker – time delay type with strips in all places set for 300% of the motor full-load current motor starter – across-the-line type capable of being energized automatically through the pressure switch or manually by means of an externally operable handle, pressure switch, running period timer – set to keep motor in operation, when started automatically, for testing as required by code. (Control equipment shall meet all requirements of NFPA No. 20.)

F. Provide ¼" scale shop drawing of fire pump room. Indicating fire pump, piping controller and jockey pump.

G. Manufacturers: Aurora, Suncroflo or equal.

H. Coordinate all final electrical requirements with Electrical Contractor.

I. Coordinate final room size with Architect.

J. Provide alternate to provide MIC Control System to aid in reducing degradation.

PART 3 - EXECUTION

3.01 Install all work in accordance with codes and recommended practices for this type of work.

3.02 Conceal all piping possible. Coordinate with the other trades to take timely advantage of available space above ceilings, in pipe and duct spaces, and elsewhere.

3.03 Provide access doors where “Fire Protection” valves, switches, or other controlling or monitoring devices are concealed. Label doors for quick location and recognition of concealed device.

3.04 Advise the Architect immediately of any conflicts between the plans and specifications. Clearly explain problem, limits of problem, and proposed solution.

3.05 Center sprinkler heads in ceiling tiles in both directions. Coordinate exact placement with diffusers, light fixtures and other ceiling mounted devices.

3.06 **Sprinkler heads shall not be painted.**

3.07 Provide as-built drawings indicating location of zones.

3.08 FLUSHING AND TESTING

A. Flush underground service piping and distribution piping before connecting underground piping to sprinkler system.

B. Arrange for proper witnessing of all tests as required by codes and authorities.

C. Make all tests in accordance with applicable codes. Test piping at minimum 200 psig hydrostatic for two hours. Flush as required by NFPA.

D. Provide a letter of certification stating that all testing and flush has been performed in accordance with the applicable codes and standards. Itemize codes and standards complied with.

3.09 All sprinkler piping is to be routed in conditioned space to prevent freezing and concealed above ceiling, furr-outs or other Architectural features whenever possible. Coordinate changes in elevation, piping between floors and adjoining spaces with Architectural drawings to ensure that piping will not be exposed to finished spaces. **Any piping that must be exposed is to be coordinated with Architect and indicated on shop drawings.**

3.10 DRY SPRINKLER SYSTEM

A. Air Compressor: Confirm final electrical requirements with Electrical Contractor(min 20amp-120v dedicated circuit). Compressor must have adequate vibration isolation so that no vibrations are transmitted to the structure or slab.

B. Nitrogen Generator: Confirm final electrical requirements with Electrical Contractor(min 20amp-120v dedicated circuit). If large system coordinate 208volt connection.

C. Provide start-up and test report showing proper functioning of Nitrogen systems, Purity Manifold operation and monitoring, including final Nitrogen Content.

D. Provide all piping and controls associated with air compressors.

E. Arrange wiring for single point connection, for each piece of equipment.

3.11 REMODEL AREA

A. Provide new heads in ALL remodel areas to match new construction standards and aesthetics based on this specification.

END OF SECTION

SECTION 22 01 00 - INSIDE UTILITY TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes general requirements, products, and methods of execution relating to excavation, backfill and compaction of inside trenches for mechanical work. Inside trenches are those which occur within an arbitrary, imaginary boundary five feet beyond the outside perimeter of the structure.

B. Scope: Provide all trench work for mechanical work of every description and of whatever substance encountered to the depth indicated, or to provide pipe slopes and elevations shown on the drawings. Excavate and backfill utility trenches. Place and compact bedding material. Compact backfill material.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE CODES

A. Local Codes and Ordinances

B. Texas Safety Standards

C. OSHA - Section 1926.650

1.03 SAFETY PRECAUTIONS AND PROGRAMS

A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

PART 2 - BEDDING MATERIAL

2.01 BEDDING MATERIAL

A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.

B. Use clean sand. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material compatible with structural backfill is not available from trench excavation, import it from sources approved by the Architect.

B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size four inches (4").

PART 3 - EXECUTION

3.01 EXCAVATION

A. Place all excavated material suitable for backfill in an orderly manner, and in conformance with safety codes.

B. Dispose of all material not suitable for backfilling.

C. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If trenches are below specified grade, backfill to required depth with select granular materials free from debris and rock, and compact to proper grade before installing piping.

D. Follow manufacturer's recommendations for minimum trench width, material type and cover requirements.

3.02 LOCATION

A. Locate trenches to accommodate utilities shown on the drawings.

B. Construct trench with adequate width to allow compaction equipment to be used at the sides of pipes.

C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DEWATERING

A. Perform whatever work is necessary to prevent the flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

A. Do not backfill until underground mechanical system has been properly tested, inspected and approved.

B. Coordinate with the work of others and complete all trench work in a timely manner.

3.05 BEDDING

A. Place bedding material under, around, and over the pipe in lifts not exceeding 8" in depth.

B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.

C. Cover pipe with bedding material to building subgrade or to a minimum 12" depth before adding other backfill.

3.06 BACKFILLING

A. Continue placing backfill material until trench is completely filled to building subgrade, or as shown on the drawings.

B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.

B. Compact all backfill under footings, slabs, and other structures to 95% of maximum density or more, if required by the Architect.

C. Compact other areas to preclude future settlement, or at least 85% of maximum density.

3.08 FINISHING

A. After completion of backfilling, dispose of excess material and smooth the surface to grade.

B. Do not allow heavy equipment to be used over backfilled work that does not have sufficient cover to prevent pipe damage.

3.09 SPECIAL PRECAUTIONS

A. Avoid unauthorized and unnecessary excavations.

B. Minimize number and size of excavations under footings or bearing walls.

C. Support footings, foundations, and walls with timbers and jacks if there appears to be any possible chance of damage and keep such precautions in place to eliminate possible damage.

D. Backfill under footings and bearing walls, using maximum compaction or concrete of proportions as specified for footings.

E. Avoid damage to all existing underground services, foundations, cables, conduit lines or foundations. Repair any existing underground work accidentally damaged at no additional cost to the Owner.

3.10 UNDER EXISTING SLAB INSTALLATION

A. When breaking out an existing floor slab, make a saw cut and remove concrete. When repouring concrete, compact the fill to the same specifications as the building fill. Re: Architectural/Structural. General Contractor to make necessary saw cuts and patching as required. **Coordinate penetrations of existing grade beams with structural engineer.**

3.11 UNDER SLABS ON VOID FORMS:

A. Piping installed in expansive soil conditions or where slabs are required to be protected from expansive soils, have two installation options.

1. Structured Slab: Pipes must be suspended from structured slab in crawl space. Isolated from expansive soils. Must provide flexible connections at all civil or building perimeter connections where there is a transition from suspended to expansive soil. (CW, Waste, Storm, Fire etc...) Coordinate acceptable types with structural and plumbing documents.

2. Slab on Void: Pipes must be protected / isolated from expansive soil when slab must be protected. When this Slab construction is used. The Basis of Design for plumbing protection is "Mud Skipper". Alternative must be approved prior to acceptance. Must provide flexible connections at all civil or building perimeter connections where there is a transition from suspended to expansive soil. (CW, Waste, Storm, Fire etc...) Coordinate acceptable types with structural and plumbing documents.

END OF SECTION

SECTION 22 11 16 - WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.

B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 CONNECTION TO UTILITY WATER SYSTEM

A. Coordinate with site utilities to properly locate and interface with the water supply. Stub water 5'-0" outside the building and make connection to water supply. See Civil Drawing for site utility locations.

B. When No Civil Engineer: Coordinate with site utilities to properly locate the water supply and make the connection in accordance with approved practices. Obtain all permits, pay fees, and provide all service incidental to this work.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS ABOVE GROUND (INSIDE STRUCTURE)

A. Type "K" or "L" hard drawn copper tubing, wrought solder type fittings, lead free (0.00% lead content) solder or brazed or press fit joints by Viega, Nibco or Apollo.

2.02 PIPING AND FITTINGS BELOW GROUND

A. 2" and Smaller:

1. Type “K” soft copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.

2. Use heavy duty Water-Tite-Sleeve as manufactured by IPS Corporation for all piping under slab. Sleeves for 1" and under shall be 25 mil., blue for cold water and red for hot water. Sleeves for 1 1/4" to 2" shall be 6 mil., black in color.

B. 2-1/2" and Larger:

1. Type “K” hard drawn copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.

C. No joint to be installed under building slab.

D. When No Civil Engineer: PVC Schedule 40 thermoplastic pipe may be used as allowed by code and/or governing authority from a point 5' from building to source of water supply. All fittings to be Schedule 80 PVC.

2.03 WATER METER

A. Reference Civil Drawings

PART 3 - EXECUTION

3.01 GENERAL METHODS

A. Make all joints in accordance with manufacturer's recommendations. The tools used shall be the tools adapted to that specific purpose.

B. At all fixtures, install and connect hot water on left and cold water on right, as viewed when facing the fixture.

C. Where required for connections to fixtures, equipment items, etc., employ lengths of red brass pipe with threaded ends of copper to IPS adapters, brass couplings, etc., to the end that there shall be no ferrous pipe in any water piping system.

D. Provide valves on each branch line at the point of connection into the supply and circulating mains serving all batteries of plumbing fixtures. Provide stop valves in each water supply for every plumbing fixture. Each hose bibb is to have an individual shut off valve, separate from valves that would shut down a battery of fixtures. Valves for piping two inches (2") and smaller shall be ball valves.

E. Provide water hammer arrestors with accessible isolation valve on cold water and hot water supplies to ALL plumbing fixtures. Provide access door for all concealed arrestors. Water Hammer Arrestors shall be certified by the Plumbing and Drainage Institute (PDI) Standard WH-201. **Arrestors are to be installed in locations and sized per Manufacturer’s installation instructions and the latest edition of the Water Hammer Arresters Standard PDI WH 201. When a battery of fixtures exceeds 20’ in length, then an additional arrestor is required. Contractor to provide a plan showing water hammers locations, size and fixture unit count on each branch line used to size arrestors.**

F. Install vacuum breakers on all plumbing lines where contamination of domestic water may occur and on boiler make-up lines and hose bibbs.

G. Provide Reduced Pressure Zone (RPZ) assembly backflow preventor at each piece of equipment including steamers, Combi-Ovens, coffee machines, tea machines, ice machines, etc. Route relief drain to nearest floor sink, floor drain or other code approved disposal point. This must be an indirect connection or have an air gap fitting.

H. Insulate all exposed water connections for handicapped lavatories and sinks with “Handi Lav-Guard” Insulation Kit (Phone: 203-875-2868).

3.02 TESTING

A. Test all water piping hydrostatically at 150 psig or 150% of working pressure, whichever is greater, for a period of 24 hours. Observe piping during this period and repair all leaks. Test for lead, certify that lead residual in piping system does not exceed local code requirements.

3.03 STERILIZATION OF DOMESTIC WATER SYSTEMS

A. Sterilize each unit of completed supply line and distribution system with chlorine solution before acceptance for domestic operation.

B. Accomplish sterilization as described below or by the system prescribed by the American Water Works Association Standard C-601. Apply the amount of chlorine to provide a dosage of not less than 50 parts per million. Provide chlorine manufactured in conformance to the following standards:

1. Liquid Chlorine: Federal Specification BB-C-120.

2. Hypochlorite: Federal Specification 0-C-114a, Type 11, Grade B or Federal Specification 0-X-602.

C. Introduce the chlorinating material to the water lines and distribution system after piping system has been thoroughly flushed. After a contract period of not less than 24 hours, flush the system with clean water until the residual chlorine content is not greater than .2 parts per million.

D. Open and close all valves in the lines being sterilized several times during above chlorination.

E. The sterilization process shall be done by persons whose major business is water treatment and sterilization. The Plumbing Contractor shall pay all costs and charges associated to this test and certification.

F. Certify in writing that sterilization has been completed in accordance with these requirements.

END OF SECTION

SECTION 22 13 16 - LIQUID WASTE TRANSFER

PART 1 – GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products, and methods of execution relating to the transfer of liquid waste for the project. The work of this section includes providing the following:

a. All liquid waste piping and fittings:

1) Soil

2) Rain leaders

3) Building sewer

b. All plumbing vents, including their termination.

c. All connections at points of collection of handling:

1) At plumbing fixtures and trims

2) At equipment by others

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E 84.

PLENUM RETURN: PVC OR CPVC CAN NOT BE USED IN PLENUM SPACES IN LIEU OF CAST IRON, IT WILL NOT MEET 25/50 REQUIREMENTS.

IF PVC OR CPVC IS USED IN PLENUM SPACES IN LIEU OF CAST IRON, THEN PIPING MUST BE WRAPPED WITH CODE APPROVED INSULATION TO PROTECT PIPING AND MEET 25/50 REQUIREMENTS.

D. All waste, vent, sewer and storm lines shall be of cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International as well as conform to the requirements of CISPI Standard 301, ASTM A-888 or ASTM A-74 for all pipe and fittings, and be manufactured by Charlotte, Tyler, or AB&I.

E. All pipe and fittings shall be manufactured in the United States.

F. A complete waste and vent system will be provided to collect sanitary waste from all plumbing fixtures, floor drains, and any other equipment, in accordance with the Plumbing Code. In the event piping is not shown to a plumbing device connect waste and vent piping per “Plumbing Fixture Connection Schedule” and route waste and vent to nearest main.

G. Grade all horizontal runs of pipe in building and under floor slab at 1/4" per foot downward in direction of flow. If it is absolutely impossible to maintain a grade of 1/4" per foot, piping four (4) inches in diameter and larger may slope to a minimum grade of not less than 1/8" per foot.

H. The building will have sanitary sewer lines discharging to the site sanitary sewer system.

I. Floor and wall cleanouts will be strategically placed to avoid being located in sensitive areas.

J. Floor drains will be provided for each air handling device, equipment requiring drains, toilet rooms with water closets, and mechanical equipment rooms. A floor sink will be provided at each emergency shower unit. Floor sinks and floor drains to be provided in kitchens at ALL locations indicated by Kitchen drawings.

K. Each floor drain/sink will be provided with a p-trap and a trap primer.

1.02 CONNECTION TO UTILITY SEWER AND STORM DRAIN SYSTEMS (storm drain piping is considered to be piping beyond 5'-0" outside the building)

A. Final wastewater connection point to extend approximately five feet (5') outside the building, as indicated on the drawings. Coordinate with Civil Drawings for wastewater service point to within five feet (5') of the building. **Coordinate with site utilities to insure proper inverts for all lines and connection point prior to installation**. Contact Architect immediately if any conflict is discovered. Make final connection to service line. Obtain all permits, pay fees and provide all services incidental to this work.

B. When No Civil Engineer: Coordinate with site utilities to properly locate the sewer and make the connection in accordance with approved practices. Obtain all permits, pay fees, and provide all services incidental to this work. **Coordinate with site utilities to insure proper inverts for all lines and connection point prior to installation**. Contact Architect immediately if any conflict is discovered. Make final connection to service line.

PART 2 – PRODUCTS

2.01 SEWER PIPE UNDERGROUND INSIDE STRUCTURE (INCLUDES TO FIVE FEET FROM BUILDING PERIMETER)

A. Base Bid: Service weight cast iron soil pipe with Tyseal neoprene gaskets.

1. Epoxy coated Service Weight cast iron soil pipe to be bid as an additive or deductive alternate.

B. Schedule 40 solid core PVC (DWV pipe and fittings) as allowed by code. Material Data: Type 1, Grade 1 PVC 12454-B, ASTM D-1784.

C. Pipe 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron drainage fittings.

D. High Temperature Wastewater: Waste line piping and fittings serving floor sink for commercial dishwasher and floor trough for tilt/braising pan in kitchen and associated main to be service weight cast iron soil pipe with Tyseal neoprene gaskets, to a point twenty feet (20') downstream of dishwasher. Remainder of grease system in kitchen may be PVC as listed in 2 above.

2.02 SEWER ABOVE GROUND INSIDE STRUCTURE

A. Service weight cast iron soil pipe with tyseal neoprene gaskets or cast-iron soil pipe with no-hub fittings. Reference 2.05 below.

B. DEFAULT DELETE THIS, ONLY USE IF CUSTOMER REQUEST: Value Savings Option: Schedule 40 solid core PVC (DWV) as allowed by code. Material Data: Type 1, Grade PVC 1120, ASTM D-1784. **Verify if area is used as plenum which requires 25/50 rating.**

2.03 VENTS

A. All vent piping above slab to be cast iron soil pipe with tyseal neoprene gaskets or no-hub fittings.

B. All vent piping under slab to be heavy weight no-hub fittings.

C. DWV copper with wrought or cast solder fittings.

D. DEFAULT DELETE THIS, ONLY USE IF CUSTOMER REQUEST: Value Savings Option: Schedule 40 solid core PVC (DWV) as allowed by code. Material Data: Type 1, Grade PVC 1120, ASTM D-1784. **Verify if area is used as plenum which requires 25/50 rating.**

2.04 CAST IRON PIPE/FITTINGS

A. Tyseal Gaskets or MG Couplings.

B. Hubless couplings shall be composed of a stainless-steel shield, clamp assembly and an elastromeric sealing sleeve conforming to the most current edition of CISPI 310, listed by NSF International, manufactured in the United States of America, and manufactured by Anaco, Mission, Tyler or Ideal. Provide minimum 80LB torque standard couplings for standard fittings inside structure above slab and heavy-duty couplings with double bands rated for 120LB torque for all below slab and underground piping.

2.05 CONDENSATE AND ALL MISCELLANEOUS DRAIN PIPING

A. Type L or M: Hard drawn copper.

B. Value Savings Option: Schedule 40 solid core PVC.

2.06 ACID WASTE/VENT PIPING

A. Pipe and Fittings

1. Below Ground Waste

a. Minimum schedule 40 CPVC piping system with solvent cement joints: Spears "Lab Waste" or Charlotte "Chemdrain".

b. Minimum Schedule 40 Polypropylene or PVDF with electrofusion joints by R & G Sloan, GSR Fuseseal, Orion or IPEX Enfield.

2. Above Ground Waste and Vent (Must be plenum rated)

a. Minimum Schedule 40 CPVC (must be wrapped with insulation to meet 25/50 plenum rating) piping system with solvent cement joints: Spears “Lab Waste” or Charlotte “Chemdrain”.

b. Minimum Schedule 40 Polypropylene or PVDF with electrofusion or mechanical joints by Orion PVDF, IPEX “Labline”.

3. Above and below ground systems to be compatible.

4. All piping system components open to plenum to meet UL or ULC 25/50 requirements.

5. No mechanical joints allowed under slab.

6. All fused joints to be made with manufacturer’s recommended power block for fuse seal type piping.

B. ACID NEUTRALIZATION TANK

1. High density polyethylene tank conforming to ASTM D1248. Tank to be provided with FRP fiberglass wrapping and vent located on side of tank above inlet and outlet piping.

2. All fittings made of polyethylene and welded into all penetrations.

3. Acid dilution tank manufacturer to provide factory installed extension ring to bring top of acid dilution tank to within 3" of bottom of traffic bearing lid of supplied concrete pit. Extension ring to be same diameter as tank.

4. Manufacturer to provide full sized reinforced fiberglass circular top with manhole cleanout cap.

5. Install and fill per manufacturer's directions. Provide manufacturer's installation instructions with submittal.

6. Minimum acid neutralization tank sizes to be as follows: Up to 16 stations use a 55 gallon, 17 to 25 stations use a 100 gallon and 26 to 42 stations use a 150 gallon.

7. Provide reinforced concrete pit (diameter as required) for acid neutralization tank. Provide with openings as required for piping connections to tank and traffic bearing lid. Provide height as required by field conditions to bring top up to finished grade level.

8. Provide with limestone chip fill as required.

9. Manufacturer: Park or Equal.

2.07 EXPANSIVE SOIL – CIVIL CONNECTIONS

A. Provide Flexible Expansion Joints: “EBAA IRON INC”, FLEX-TEND, EXTEND, PVC, DUCTILE IRON.

B. Reference ‘EXPANSIVE SOIL PLUMBING GENERAL NOTES’ on plans.

PART 3 – EXECUTION

3.01 INSTALLATION OF UNDERGROUND PIPING

A. Install pipe and fittings to required grade with hubs and bottom half section in undisturbed soil. Follow manufacturer’s installation requirements.

3.02 INSTALLATION OF ABOVE GROUND PIPING

A. Refer to Section 20 01 00.

3.03 GRADING

A. Grade all horizontal runs of pipe in building and under floor slab at 1/4" per foot downward in direction of flow. If it is absolutely impossible to maintain a grade of 1/4" per foot, piping four (4) inches in diameter and larger may slope to a minimum grade of not less than 1/8" per foot.

3.04 SUPPORTING

A. Support all horizontal runs of pipe in building at intervals not to exceed 5'-0" and at each change of direction. Provide a support at the base of vertical risers with intermediate supports as required. Brace all adequately to prevent motion, per manufacturer's recommendation. Reference Section 20 01 00, 2.08, B., Mechanical Support Devices and Pipe Supports for further requirements.

3.05 CLEANOUTS

A. Provide cleanouts as shown on plans and in an accessible location at base of all risers in soil, waste and drain piping and at each change in direction in horizontal runs of pipe. In long straight runs, provide a cleanout located at intervals of not more than 75 feet for piping four inches (4”) and larger and located at intervals of not more than 50 feet for piping less than four inches (4").

B. Cleanouts shall be located no closer than 24” to a wall.

C. For each urinal a cleanout shall be installed above the fixture connection fitting. Coordinate exact location with Architect.

3.06 VENTING

A. Provide a vent for each trap, plumbing fixture and waste line required per code.

B. Extend each vent vertically to a point not less than six inches (6") above the extreme overflow level of the fixture served before offsetting horizontally. Whenever two or more vent pipes converge, extend each such pipe at least six inches (6") in height above the flood rim

level of the plumbing fixture it serves before being connected to any other vent and utilize only approved drainage fittings and materials to connect piping.

C. Provide a building main relief vent for waste piping not provided venting by fixture branch connections. Vent size shall be per code requirement, based upon fixture unit loading in the pipe vented.

3.07 VENTS THROUGH ROOF(VTR)

A. Provide as many VTR's required for proper venting of plumbing system. VTR's shown on plans are for coordination purposes, and do not represent ALL required VTR's.

B. Extend vents through the roof a minimum distance of 6" and terminate at least 15 ft. horizontally from operable windows, doors, or air intakes, and at least 3 feet above such opening. Do not terminate vents through roof at edge or valley of roof. Coordinate locations with ALL other trades and sensitive view areas with Architect prior to installation.

C. Flash and counterflash vents through roof. Provide flashings not less than 18" square, with prefabricated 4-pound lead counterflashing. Extend vertical portion of flashing up entire length of pipe and turn down inside the pipe at least 1 inch with turned edge hammered against pipe. Coordinate with type roof and Architectural details and flash them into roof according to the roofing products manufacturer's recommendations.

D. Protect the roof from tools and equipment. Remove all scraps on roof to prevent damage to roof.

3.08 GENERAL

A. No piping shall be permanently concealed before the examination is completed by the authorities having jurisdiction.

B. All fixtures used in conjunction with the conveying of waste substance shall be connected by means of a trap.

C. All connections for floor mounted water closets and waste piping shall be made with appropriate closet flange and wax gaskets.

D. Insulate all exposed p-traps for handicapped lavatories and handicap sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868) as required.

E. Provide specialty shielded transition coupling as required at connections between PVC and cast-iron fitting.

F. **Horizontal to horizontal connections cannot use double combo, double wye and one eighth or sanitary cross fittings.**

3.09 TESTING

A. Test all piping in accordance with the requirements of the local codes.

B. Repair leaks and retest system, repeating this process until piping system is free of leaks.

C. Test shall be conducted and completed before any joints are concealed or made inaccessible.

D. Maintain a log of tests indicating date, time, result of test and person doing test.

E. Under floor

1. Test pipe under floors before connecting to sewers.

2. Maintain not less than 15 feet of hydrostatic head.

3. Repair all leaks and repeat until system holds for 2-hours without a drop in water level.

3.10 CONDENSATE PIPING

A. Route insulated copper condensate drain line from each unit to nearest floor drain, deep seal traps, sink p-traps, janitor sink, dry well (exterior units), or roof drain if piped to storm sewer (cannot use roof drain if day lites at surface) code approved or disposal point unless otherwise noted. Condensate shall not drain on to roof. Mechanical Contractor and Plumbing Contractor to coordinate locations. Slope all piping to drain at minimum 1/8" per foot. Drains shall be sized in accordance with equipment capacities as follows:

EQUIPMENT CAPACITY	*MINIMUM PIPE SIZE
Up to 3 tons of refrigeration	3/4"
3 to 20 tons of refrigeration	1"
21 to 90 tons of refrigeration	1-1/4"
91 to 125 tons of refrigeration	1-1/2"
126 to 250 tons of refrigeration	2"

*Minimum size of drain shall not be smaller than drain outlet size for unit.

B. Coordinate mounting heights of units to allow adequate slope for condensate piping to disposal point.

C. Provide cleanout plug at end of each main run.

D. All condensate piping to be insulated to prevent condensation. This includes all waste piping above slab or in crawl space that has condensate draining into it. Included P-Traps and Hub Drains.

E. Drywell (French Drain): The drywell shall consist of a pit not less than 24" in diameter (or 24" x 24") and 24" in depth. The pit shall be filled to within 3" of the finished grade with course gravel. Top 3 inches to be filled with topsoil and sodded. Gravel to be wrapped completely (top, sides and bottom) with heavy duty weed block fabric. Install a 3" perforated PVC drainpipe (centered in drywell) with cap at bottom extending to bottom of pit. Install a 3" perforated pipe to extend 3" - 5" above finished grade and mounted offset of the drywell within 2” of the building for final connection of copper condensate lines. Final connection of offset perforated pipe and drywell perforated pipe shall be below finished grade. Refer to details in plans for additional information. Provide appropriately sized bushing or fittings to rigidly tie to condensate drain line from unit. Perforated pipe above grade will act as air brake connection. Twenty-four-inch (24") diameter or 24" x 24" x 24" deep can be used for up to 5-ton capacity. Thirty-six-inch (36") diameter or 36" x 36" x 24" deep can be used for up to 13-ton capacity. Forty-eight (48") inch diameter or 48" x 48" x 24" deep can be used for up to 30-ton capacity. Confirm final requirements with code authority having jurisdiction.

3.11 EXPANSIVE SOIL – CIVIL CONNECTIONS

A. Reference 'EXPANSIVE SOIL PLUMBING GENERAL NOTES' on plans. If notes are not present submit RFI and request for requirements.

END OF SECTION

SECTION 22 30 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. This section describes certain components of domestic plumbing systems, including related specific requirements, products and methods of execution. Plumbing water, waste, vent piping and other primary distribution components of the plumbing system are included with related work specified elsewhere.

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

A. All floor drains, including floor sinks, are to be the same size as the waste line size indicated on plans. If size is not indicated, drain size shall be 3". Top of floor drains and floor sinks to be square and to be flush with finished floor. Floor drains that tie into acid waste piping are to have acid resistant coating or be stainless steel. Floor Drains and Floor Sinks in kitchen areas are to have Acid Resistant Enamel coating or be constructed from stainless steel.

B. **PROVIDE TRAP PRIMING APPARATUS FOR EACH FLOOR DRAIN AND FLOOR SINK.** Whenever possible, use an inverted tee connection from sink tailpiece or device similar to Jay R Smith Prime-EZE for trap priming with gray water. Second choice is to use flush valve trap primer connection. As a last resort, provide electronic trap primer (Manufacturer: Sioux Chief 695-ES01 or equal as required) connected to supply line. Provide minimum 12 x 12 stainless steel access door or larger as required. Coordinate 120V electrical requirements with electrical contractor. **In addition, Proset "TRAP GUARD" or equivalent device must be used in ALL floor drains, floor sinks and HUB drains.**

C. **Provide both Trap Guards and Trap Primers for ALL floor drains, floor sinks and HUB drains.**

D. Trap primers must conform to ASSE 1018 or ASSE 1044 (Pflugerville allows only ASSE 1044).

E. Trap Primer Manufacturers: Sioux Chief, MIFAB, Precision Plumbing Products, Jay R Smith, Sloan, Zurn, Wade or Watts.

F. Floor Drain/Floor Sink Manufacturers: StainlessDrains, Kessel, MIFAB, Josam, Wade, Zurn or Jay.R. Smith, Watts.

2.02 ROOF DRAINS

A. Provide 30" square, four-pound lead flashing for all roof drains, centered around drain. Coordinate with type roof and Architectural Roof Plan and Architectural details. Roof drains to be installed in low point of roof. Verify low point in roof before installation. Roof drains to be moved at no additional cost to owner if not coordinated and installed in low point of roof to allow for proper drainage.

B. Where horizontal offset is not possible directly below drain connection, install an expansion joint directly under the drain. MIFAB R1900 Series.

C. All roof drains shall be same size as the rainleader piping size serving roof drain as indicated on the drawings.

D. Roof Drains:

1. RD1 Primary roof drain, cast iron body, flashing collar, gravel stop, ductile iron dome, under deck clamp, extension and sump receiver. MIFAB R1200-M-E-U Series.

2. RD2 Overflow roof drain same as RD-1, set inlet 2 inches higher than inlet of RD-1. MIFAB R1200-M-E-U-W. Coordinate and confirm final location with roofing consultant prior to rough-in.

E. Manufacturers: StainlessDrains, MIFAB, J.R. Smith, Zurn, Josam, Wade, Watts or approved equal.

2.03 CLEANOUTS

A. Cleanouts shall be same nominal size of pipelines up to four inches (4") and not less than four inches (4") for larger lines.

B. Floor Cleanouts: Gas and watertight seal, internal taper ABS cleanout plug, stainless steel or nickel bronze finish, scoriated square top with countersunk screw for installation flush with finish floor. MIFAB C1100R-3 Series. If floor has a waterproof membrane, then add C clamp ring flange.

C. Wall Cleanouts: MIFAB C1400-RD Series. Countersunk plugs, with smooth round access cover and polished stainless steel or nickel bronze finish.

D. Manufacturers: StainlessDrains, MIFAB, Josam, Zurn, Wade, Watts or approved equal.

E. Cleanouts that tie into acid waste piping to be acid resistant.

2.04 FIXTURES

A. Manufacturers:

1. The fixtures are chosen from standard manufacturers.

2. Provide all similar fixtures and trim from one (1) manufacturer, except where specified otherwise.

B. Traps, Stops and Supplies:

1. Provide traps, stops and supplies for all fixtures.

2. P-Traps and Tail Pieces: 17-gauge chrome-plated cast brass. Provide offset type as required to meet ADA space requirements.

3. Supplies: Flexible, chrome-plated, 7538 Series.

4. Stops: Quarter (1/4) turn removable key type, 2302 Series.

5. Supplies and stops are to meet current requirements of NSF61.

6. Manufacturers: American Standard, Brass Craft, McGuire or equal.

C. Fixtures Specified Elsewhere, or Otherwise Furnished. Provide appropriate strainer, tailpiece, trap, waste and supplies. Rough-in and connect only.

D. Faucets:

1. All faucets except commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed by NSF as residential drinking water faucets.

2. All faucets not NSF 61 listed, (as described in paragraph 1) must have tin lined waterways or other such material so water flowing through the faucet is not in contact with any material that could allow “Leaching” of lead into the waterway.

3. Commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed as commercial faucets. Faucets meeting the stricter residential standards can be used at contractor’s option.

4. Faucets are not allowed to have more than the maximum total lead content as listed by NSF, TCEQ (Health and Safety Code) and EPA.

5. Any faucets which exceed lead concentration “Leaching” into water stream after a minimum of 45 days usage and proper flushing prior to testing shall be replaced by the manufacturer with an acceptable product. All costs of change out incurred will be sole responsibility of the manufacturer.

6. Lavatory faucets to have .5 GPM vandal resistant aerator.

E. Waterways and tanks for all drinking fountains and water coolers shall be constructed of 3. lead-free (0.00% lead) materials. All waterways to be totally free of lead. No lead solder is permitted. All drinking fountains and water coolers to meet latest criteria of TCEQ, EPA and be listed by NSF.

F. All water line, fittings and fixtures in contact with potable water to be “lead free” AB1953 compliant. (.25% or less average lead content). All submittals to state items comply in submittal package.

2.05 FIXTURE FLOW RATES

A. The maximum flow rates for plumbing fixtures are to be no greater than quantities listed below or the maximum applicable code or ordinance allowed flow rate, whichever is less:

1. Toilets – 1.28 gallons per flush GPF) on all projects.
2. Urinals – 0.125 gallons per flush (GPF) on all projects
3. Lavatory (hand sink) – 0.5 gallons per minute (GPM) on all projects
4. Shower – 2.0 gallons per minute (GPM) on all projects

PART 3 - EXECUTION

3.01 Store all fixtures and trim above ground in a covered location not subject to accidental damage by traffic or other construction activities. Handle fixtures and trim carefully to avoid chipping, denting, scratching, or other damage. Replace damaged items with same item in new condition.

3.02 Provide permanent metal and wire positioners, supports and fixture carriers to secure fixtures and piping rigidly in proper alignment without sway or side play.

3.03 Anchor all fixtures securely to withstand applied vertical load of not less than 250 pounds on the front of the fixture, without noticeable movement.

3.04 Install all fixtures plumb, level and flush to the finished Architectural surface, so that the maximum gap between the fixture and the surface does not exceed 3/16 inch. **Grout** under water closets to level fixtures. Caulk the edge of the joint between fixture and surface with silicone or butyl type waterproof caulking compound.

3.05 Adjust all functional components for proper operation in accordance with manufacturer's recommendations, or as otherwise directed.

3.06 Clean all fixtures and trim thoroughly to a spotlessly clean condition. Obtain a written certification from the Architect that this has been accomplished.

3.07 Where floor drains or janitor sinks are located over any room, provide waterproof installation.

3.08 Ensure final location of cleanouts have access and ample clearance at cleanout for rodding of drainage system. Check locations before installation. Contact Architect for alternate location if maintenance clearance is a problem. Cleanouts to be moved at no additional cost to Owner for failure to coordinate locations.

3.09 Coordinate slope of floors to floor drains with Architect. Adjust height of floor drain for proper drainage.

3.10 Provide all adapters, flanges, gaskets, etc. as required for proper installation of fixtures. Coordinate fixture placement before core drilling of floor or sleeve installation.

3.11 Insulate all exposed p-traps and water connections for handicapped lavatories with White Dearborn Brass ADA100 resealable foam Insulation Kit or equal. Kit to fit straight or offset drain as required.

3.12 **No offset flanges will be allowed for installation of water closets.**

3.13 Install all trap priming devices per manufacturer’s installation instructions. Provide shut-off valves at each mechanical or electronic trap primer for service. Install minimum 12” x 12” access doors as required for service of trap priming devices.

3.14 Provide a floor sink with trap priming device in each sprinkler riser room.

3.15 Provide waste, cold water, hot water, and vent piping to ALL plumbing fixtures as described in Plumbing “Fixture Connection Schedule” and in any kitchen drawings by others.

3.16 **Cleanout locations:**

A. **On each horizontal drain line 5 feet or greater in length.**

B. **No more than 50 feet on center.**

C. **At changes in director of 90 degrees or more (line size).**

D. **At the end of each continuous waste line.**

E. **At the end of each battery of fixtures.**

F. **At each sink and urinal.**

G. **Additional areas required for service and by code.**

END OF SECTION

SECTION 23 05 93 – TEST AND BALANCE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The section describes general requirements and methods of execution relating to the testing and balancing of the mechanical systems provided on this project. Plans and specifications are complimentary. Carefully look at both.

B. Scope:

1. Furnish the services of a qualified and approved Testing and Balancing Agency to perform the work of this specification.

2. The work of this section includes, but is not necessarily limited to:

a. Testing and balancing all fans, all air handling systems, all energy recovery ventilators and makeup air systems.

b. Providing a final report. Final report to be submitted for review only after all deficiencies have been corrected and design CFM's are achieved.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE STANDARDS

A. SMACNA Manual for the Balancing and Adjustment of Air Distribution Systems.

B. AMCA Publication 203, Field Performance Measurements.

C. AMCA Standard 300-67, Test Code for Sound Rating.

D. National Environmental Balancing Bureau (NEBB) Recommended Procedures.

E. National Balancing Council (NBC)

1.03 PRE-QUALIFIED AGENCY

A. Subcontractor Minimum Qualifications Include:

1. Maintain a complete service organization that has operated within a one hundred (100) mile radius of the project for at least three years prior to bid date of this project.

2. Demonstrate satisfactory completion of three projects of similar size and scope. Provide references if requested.

B. Bids by suppliers, Contractors or any firm not listed in #5 below are not acceptable.

C. Independent, NEBB or TABB certified agency with no affiliation to mechanical contractor.

D. Pre-qualified T & B Agencies are as follows:

1. Fluid Balance (512)826-8234

2. Complete System Balance – (972-965-4289)

3. PHI (512)339-4757.

4. CenTex Air Balance Inc (254)913-3132.

5. Air Technologies (512)280-3398.

6. Additional Owner Approved T&B firms bid as an alternate and submit forms.

1.04 TIMING OF WORK

A. Do not begin testing and balancing until the systems are completed and in full working order.

B. Schedule the testing and balancing work in cooperation with other trades.

C. Complete the testing and balancing before the date of final project completion.

1.05 MECHANICAL CONTRACTOR RESPONSIBILITY TO BALANCING AGENCY

A. Award the test and balance contract to the approved agency upon receipt of contract to allow the Balance and Testing Agency to schedule this work in cooperation with other trades involved and comply with completion date.

B. Put all heating, ventilating, and air conditioning systems, equipment and controls into full operation for the Balancing Agency and continue the operation of same during each working day of testing and balancing.

C. Provide scaffolding, ladders and access to each system for proper testing and balancing.

D. Provide and change pulleys, belts and dampers, add any dampers and correct any installation errors in a timely matter as required for correct balance as recommended by the Balance and Testing Agency or as directed by the Architect after review of Balancing Report, at no additional cost to the Owner.

E. Fix ALL deficiencies noted in T&B report prior to submitting report to Engineer.

PART 2 - PRODUCTS

2.01 THIS PART NOT USED.

PART 3 - EXECUTION

3.01 INSTRUMENTS

A. Maintain all instruments accurately calibrated and in good working order. Use instruments with the following minimum performance characteristics.

B. Air Velocity Instruments: Direct reading in feet per minute, 2% accuracy.

C. Static Pressure Instruments: Direct reading in inches water gauge, 2% accuracy.

D. RPM Instruments: Direct reading in revolutions per minute, 1/2% accuracy; or revolution counter accurate within 2 counts per 1000.

E. Temperature Readout: Direct reading in degrees F., plus minus 0.1 degrees F.

3.02 GENERAL PROCEDURES FOR ALL SYSTEMS

A. In cooperation with the Contractor's representative, coordinate adjustments of automatically operated dampers and valves, including the controlling thermostats, to operate as specified, indicated, and/or noted.

B. Use manufacturer's ratings on all equipment to make required calculations.

C. MAKE FINAL ADJUSTMENTS FOR EACH SPACE PER HEATING OR COOLING COMFORT REQUIREMENT. State reason for variance from design cfm, i.e., “too noisy”, “too drafty”, etc.

D. Balancing to occur with clean filters when applicable and wet coils when applicable.

3.03 REQUIREMENTS FOR ALL AIR HANDLING SYSTEMS

A. Identify each diffuser, grille, and register as to specific location and area.

B. Identify and list size, type and manufacturer of diffusers, grilles, registers and all equipment tested.

C. In readings and tests of diffusers, grilles and registers, include required fpm velocity and required cfm and test cfm after adjustments. If test apparatus is designed to read cfm directly, velocity readings may be omitted. Identify test apparatus used. Identify wide open (W.O.) runs.

D. Adjust all diffusers, grilles and registers to minimize drafts and excess noise in all areas.

E. **Before any Test and Balance work begins, the Test and Balance Contractor shall insure that there is an adequate return air path above the ceiling (plenum) for all systems. This includes makeup air for exhaust fan, ERV’s, etc. The maximum velocity (FPM) through opening/ducts not to exceed 800 FPM. Test and Balance Contractor to verify that all plastic covering transfer openings have been removed. Provide a written report to Engineer that all systems have adequate return air/makeup air pathways prior to starting any work. When all of the pathways have been established testing and balancing may begin.**

3.04 BALANCING LOW VELOCITY DUCTWORK

A. **After adjusting blower to lowest overall point possible, adjust the branch dampers so that each stale air exhaust inlet or outside air supply outlet in the system is to + or - 5% of design airflow on all makeup air units and energy recovery ventilators.**

B. All other HVAC systems on the project are to be adjusted as per 'A' above except to + or - 10% of design airflow per air device outlet. Air device outlet deviation higher than + or – 10% is not acceptable, even if total unit deviation is within tolerance. **However, DX comfort cooling units are to be balanced to never exceed 400 cfm/ton or be less than 300 cfm/ton on highest stage. Notify engineer if plans deviate from this CFM range for guidance. 5 ton units must be balanced to provide under 2000 CFM. Use CFM shown at air devices, *not* nominal CFM shown on equipment schedule. See Standard Notes on RTU Master Schedule. For units with 2-stage scroll compressors on low stage cooling, set units to provide approximately 66% of high stage cooling CFM and discharge air in cooling should be at or below 56°F or CFM should be lowered until achieved.**

C. **Adjust the fan for design airflow on constant volume systems. Adjust fan for highest stage airflow on all systems with varying airflow, with fan and compressor on highest stage. On multistage units requiring it, set up fan to match all lower stages of cooling as required. If unit is set up incorrectly with T&B done for high stage with unit only asking for lower stage compressor stage, unit will not dehumidify and balance will have to be redone at no additional cost. Verify proper procedures with equipment manufacturer and engineer**.

1. Record Discharge Air Temp in High and Low speed Cooling

   a. If unit has additional cooling speeds record Discharge Air Temp in all cooling speeds.

2. Record Discharge Air Temp in High and Low speed Heating

3. For variable speed units that control to discharge air temperature, set discharge at temperature for cooling to 54 degrees.

D. Read and record the airflow at each return or exhaust inlet and each supply outlet. Balance as required on constant volume and/or highest stage.

E. Secure each branch damper and mark the balanced position of the damper quadrant.

F. Adjust fan for each stage of airflow (to match compressor staging) on all systems with varying airflow. Discharge air for all stages should be 56°F or lower in cooling.

G. Read and record the airflow at each supply outlet in high and lowest stages. On infinite variable flow blowers on units with variable speed compressors measure and record airflow at lowest stage of compressor loading.

H. 2 to 6 ton units are generally 2 stage with compressor capacity of either 66% of rated tonnage on low stage or 100% of capacity on high stage. For these units air device CFM is used for high stage operation and low stage CFM is to be set for approximately 66% of listed air device CFM. Some manufacturers have built in logic to drop fan speed to match cooling stage and some require it to be set manually.

I. For larger units with multiple compressors, set blower CFM to match capacity of operational stage(s) of cooling. Confirm capacities and required CFM setting procedures for blower with equipment supplier. Default is 66% of high stage cooling when there are two stages of cooling. Discharge air for all stages should be 56°F or lower in cooling.

J. For chilled water AHU's set airflow on high to match air device CFM shown. Read sequence of operation. If blower CFM is integrated to chilled/hot water valve opening position, also record lowest blower CFM setting allowed (usually about 35% of air device CFM shown).

3.05 FAN ADJUSTMENT

A. Balance ductwork before making final fan adjustment for highest stage or constant volume.

B. Verify that system is free of debris and that inlets and discharges are not obstructed and that filters are clean.

C. Make pitot traverse of main ductwork to determine total airflow and record.

D. Adjust fan rpm to obtain design airflow.

E. Test and record motor amperage and voltage on each phase leg. Reduce fan rpm if necessary, so that motor running amperage does not exceed motor nameplate amperage. Record final amperage and voltage.

F. Record fan rpm.

G. Test and record system (suction) return and (discharge) supply static pressures on highest CFM.

H. Record airflow. Record total Airflow in all speeds High / Medium / Low or High / Low depending on unit design.

I. Test and adjust system for minimum design cfm outside air (intake and exhaust), as shown, where applicable.

J. **Test and record entering air temperatures across coils and fans on highest and on lowest stages of cooling/heating**.

K. **Test and record leaving air temperatures (heating and cooling) across coils.**

1. Record Discharge Air Temp in High and Low speed Cooling

2. Record Discharge Air Temp in High and Low speed Heating

3. For variable speed units that control to discharge air temperature, set discharge at temperature for cooling to 54 degrees.

L. **Make-Up/Outside Air Machines: Test and record entering air temperature and humidity plus discharge air temperatures and humidity delivered to space on all makeup air/outside air units in cooling mode. CFM to be set minimum to specified CFM up to 5% over on Airflow Monitoring Station. CFM should not be under design.**

M. Test and record static pressure drop across each filter and coil bank on highest stage.

N. Provide test data for each AHU, FCU, RTU, MAU, ERV, EF, SF, ETC., used on project:

O. Test and document operation of each MAU, RTU, AHU, CU, HP and FAN in all modes of operation and in all stages of operation. Insure that all pieces of HVAC equipment are functioning properly and are properly connected to the control system. **Check and document inlet and outlet temperatures in all stages of cooling, heating, reheat and emergency heating modes, if unit is so equipped.**

3.06 BALANCING REPORT

A. Compile the test data and submit PDF of the complete test data for forwarding to the Architect for acceptance and/or analysis and recommendations. Report must be complete, and ALL deficiencies corrected prior to submittal to architect.

B. Include a complete list of all test equipment used, including apparatus manufacturer's name, model number, serial number and date last calibrated.

C. Include complete identification of all elements. Identify by unit number, room name and number, air outlet symbol, etc., to clearly and positively identify the location of each element.

D. Include all test data specified in addition to test data recommended in the applicable standards referenced in Part 1. Tabulate all nameplate data at all balanced equipment and at the associated motors.

E. Tabulate data separately for each system. Describe balancing method used for each system.

F. Include at the front of the report a summary of problems encountered, deviations from design, resolution of problems, recommendations and comments.

G. For Multi-Speed/Stage units provide and record Discharge Air Temps at ALL stages.

1. Record Discharge Air Temp in High and Low speed Cooling (if discharge air is above 56 degrees, contact mechanical contractor and coordinate remedy)

2. Record Discharge Air Temp in High and Low speed Heating

3. For variable speed units that control to discharge air temperature, set discharge at temperature for cooling to 54 degrees.

H. Reports missing the following will be rejected and resubmitted. Commissioning will not begin until all of the following have been completed for all Cooling and Outside Air Machines.

1. Discharge Air in Cooling – for High and Low Speed

2. Discharge Air in Cooling with Outside Air Damper open – in High and Low Speed.

3. Discharge Air in Dehumidification mode, when equipped.

4. Discharge Air in Cooling above 56 degrees in any stage of cooling. Must be addressed with Mechanical Contractor.

3.07 Reference “Start-Up Report Verification” in the General Provisions Specification.

END OF SECTION

SECTION 23 30 00 - AIR DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description: This section describes specific requirements, products and methods of execution relating to the project air distribution systems.

B. Provide all air distribution systems as shown and specified, complete in every detail and in perfect operating order.

C. All equipment warranties to be per Specification Section 20 00 00, 1.17.

D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 Provide all air distribution work in accordance with the minimum provisions of the latest approved editions of the following codes and standards.

A. NFPA 90 A - Air Conditioning and Ventilating Systems.

B. NFPA 90 B - Warm Air Heating and Air Conditioning.

C. SMACNA - Low Velocity Duct Construction Standards.

D. TIMA - Fibrous Glass Duct Construction Standards.

E. SMACNA - Duct Liner Application Standard.

F. SMACNA - Ducted Electric Heat Guide.

G. AMCA Standard 210-74 Laboratory Methods of Testing Fans for Rating Purposes.

H. AMCA Pub. 261 Directory or Products Licensed to Bear the AMCA Certified Rating Seal.

I. AMCA Standard 300-67 Test Code for Sound Rating.

J. AMCA Standard 301-65 Method of Publishing Sound Ratings for Air Moving Devices.

K. AMCA Publication 511-75 Certified Ratings Program for Louvers, Dampers and Shutters.

L. ASHRAE Standard 52-76 Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

M. ASHRAE Standard 70-72 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

1.03 Where any references to “sheetmetal work” or “ductwork” appears in this section of these specifications or on the drawings, it shall be construed to include outside air ducts, supply air ducts, return air ducts, exhaust ducts, relief ducts, plenums, duct taps, grille taps, diffuser connections and all other related pieces and parts of the air conveying systems.

1.04 Before starting shop drawings or fabrication of any duct work, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, grille patterns, etc.

PART 2 - PRODUCTS

2.01 FANS

A. General Requirements for All Fans:

1. All fans constructed to AMCA Standards, AMCA listed and labeled.

2. Bearings:

a. At factory assembled package units 1HP and larger, provide 200,000-hour bearings (AFBMA L-50) selected at maximum fan rpm.

b. At packaged equipment 3/4HP and smaller, provide manufacturer’s standard bearings.

c. Arrange equipment for easy access to lubrication fittings. Provide extended grease lines whenever easy access is not possible.

3. Balance fans statically and dynamically at factory.

4. Factory paint fan housing, fan wheel (except aluminum), frame and support brackets with prime coat and enamel finish coat at factory, after properly preparing surfaces.

5. Arrange fans to be cleanable and so that wheel, bearings, shaft, and drive are removable. Provide plug type cleanout doors or split fan housing. Gasket joints and bolt airtight.

6. Provide vibration isolation for all fans per manufacturer’s recommendations.

7. Assemble fans at factory and test with permanent motor for proper operation, alignment, and balance.

8. **All fans are to be of similar size and operational characteristics as fans scheduled. Smaller fans run at higher speeds will not be accepted.**

9. All Exhaust and Make-up Air fans to have dampers. If backdraft dampers are not provided as an integral part of the fan provide a motorized parallel blade damper, the operator voltage / phase to match the voltage / phase of the fan that it is serving. If the voltage / phase cannot be matched provide transformers, relays, etc. required to interlock the damper with the fan.

10. Acceptable Manufactures: Greenheck - Accurex, Loren Cook, ILG, Penn, Briedert, Carnes and Twin City, CaptiveAire – Thermotek.

B. Belt Drives (All Belt Driven Fans):

1. Provide V-belt drive with sufficient belts to prevent slipping at start-up. Select drive for 1.5 service factor.

2. On each fan 10HP and smaller, provide variable pitch drive sheave with infinitely adjustable pitch diameter. Select drive sheave and fan pulley combination to provide fan rpm with drive adjusted to near mid-span.

3. On each fan 10HP and larger, provide a fixed speed drive sheave. Change fan and drive sheave in field to attain specified air delivery at completion of balancing.

4. Provide belt guard with hinged tachometer cap.

C. Roof Mounted Exhaust Fans:

1. Direct drive or have adjustable pitch v-belt AS SCHEDULED.

2. Wheels shall be backward curved, and housing shall be removable or hinged aluminum.

3. Isolate motor with vibration dampeners.

4. **Provide with motorized backdraft dampers unless gravity backdraft dampers are specifically listed on schedule. Damper actuator voltage to match fan voltage. Electrical Contractor to tie damper into fan power.**

5. **Insulated, pre-fabricated metal roof curb shall be for flat or sloped roof as required for fan to be set level on roof.**

6. **Provide with galvanized or aluminum bee screen.**

7. Maximum motor and fan rpm is not to exceed scheduled rpm by more than 50 rpm.

8. Provide with roof curb to match roof slope. Curb to be a minimum of 14” above finished roof.

D. Ceiling Exhaust Fans:

1. Centrifugal wheel with inlet perpendicular to, or remote from, inlet grille. Acoustically insulated housing.

2. 85% free open area grille.

3. Electrical junction box on fan housing with cord, plug, and receptacle inside housing.

4. Fan, motor, and wheel assembly removable through grille without disturbing housing.

5. **Motor mounted on rubber-in-sheer isolators, grounded, maximum motor and fan rpm shall not exceed scheduled rpm by more than 50 rpm.**

6. Unit supplied with grille when indicated by model number scheduled.

7. Provide and install roof cap or wall cap as shown.

8. Unit UL labeled.

9. Integral backdraft damper, shatterproof, with no metal to metal contact.

E. Utility Sets:

1. Direct drive or adjustable pitch V-belt as scheduled.

2. B. I., Airfoil or Radial Wheel as scheduled.

3. Configured as scheduled.

4. Provide with access panel and drain.

5. Provide weather cover when fan is located outdoors.

6. Provide with three foot (3') high "no loss" discharge stack with butterfly damper.

7. Provide with Pate Universal Curb Model PUC-2 with full CDX plywood deck and galvanized steel counterflashing cover with optional duct opening.

8. Utility sets to set on roof unless specifically noted otherwise.

2.02 FAN ACCESSORIES

A. Flexible Fan Connectors:

1. Provide at inlet and discharge of each fan, ERV, MAU, air handling unit, etc.

a. For Standard Application:

1) Material suitable to withstand the pressure encountered. Constructed from coated heavy glass fabric, flameproof and ozone resistant. Joints to be sealed airtight. Minimum of 3" flex connection to be used.

2) Manufacturer: Duro-dyne Corporation "EXCELON" or equal.

b. For Outdoor Installations and Where Duct is Exposed to Toxic Fumes:

1) Material suitable to withstand the pressure encountered. Constructed from heavy glass fabric, double coated with "Neoprene", non-combustible and fire retardant. Fabric to be waterproof and airtight. Minimum of 4" flex connection to be used.

2) Manufacturer: Duro-dyne Corporation Duralon or equal.

2. Insulate over flex connection at inlet and discharge of all air handling units and rooftop units with minimum two-inch (2") Type "C" insulation with minimum installed "R" value of 6.0. Seal termination of external insulation to ductwork with Childers CP-11 mastic with 3" glass fiber reinforcing mesh. Do not seal over any access panels.

2.03 DUCTWORK

A. **Mechanical Contractor shall insure that there is an adequate return air path above the ceiling (plenum) for all systems. This includes makeup air for exhaust fan, ERV's, etc. The maximum velocity (FPM) through opening/ducts not to exceed 800 FPM. Provide internally lined duct with a ninety-degree elbow turned up on both ends through sound walls. It is the Mechanical Contractor's responsibility to field verify return/transfer air pathways. Prior to Air Balance Contractor starting work, verify that all plastic covering transfer openings have been removed. Mark all openings (include sizes) on shop drawings and indicate walls that are not run to deck. If the job is complicated provide a separate sheet(s) for return air paths.**

B. Low Velocity Ductwork Systems:

1. Definition: Ductwork systems where duct pressures do not exceed 2" W.G. maximum static pressure and duct velocity does not exceed 2000 FPM. **Minimum duct gauge to be 26 gauge.**

2. All ductwork connected to louvers is to be sloped back to louver to insure that any water entering the duct drains back to the exterior of the building.

3. Ductwork Construction:

a. Ductwork, unless otherwise specified herein, shall be constructed of new, prime grade, continuous hot dip mill galvanized, lock forming quality steel sheets and shall have a galvanized coating of 1-1/4 ounces total for both sides per square foot. The gauges of metal to be used and the methods of duct construction shall conform to the requirements for the class of work involved as set forth in the latest edition of "Standard Practice in Mechanical Sheet Metal" as published by SMACNA. Each sheet shall be stenciled with the gauge and manufacturer's name. If coil steel is used, coils shall be stenciled throughout on ten-foot (10') centers with the gauge and manufacturer's name. Insulate per Specification Section 20 07 00.

b. All dimensions are inside clear dimensions. Sheet metal size shall be increased to allow for duct liner where applicable.

c. Seal all transverse joints, seams, and fitting connections with "Ductmate Proseal", Childers CP-146 or Foster 32-19, UL listed Mastic to prevent air leakage. Oil base caulking and glazing compounds are not acceptable. Duct sealant must meet VOC units per South Coast Air Quality Management District (SCAQMD) Rule #1168.

4. Rectangular Ducts:

a. Where special rigidity or stiffness is required, construct ducts of metal two-gauge numbers heavier.

b. Ducts larger than 96" require special field study for gauging and supporting and supporting methods. (Furnish shop drawings for supporting and construction requirements.)

c. Rectangular low-pressure ducts shall be constructed, braced, and reinforced in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

5. Round Ducts:

a. Construct round ducts from steel sheets, U.S. Gauge thickness, per SMACNA standards.

b. All exposed round ducts shall be double wall spiral duct per SMACNA standards with segmented fittings regardless of size.

c. Supply, return and exhaust duct runouts to/from air device shall be gauges as follows:

1) up to 12” diameter 30 gauge,

2) 14” to 18” diameter 28 gauge, and

3) 20” to 22” diameter 26 gauge.

Provide minimum 26 gauge, 1” wide strap on heel and throat of adjustable fitting to provide additional rigidity.

6. Transitions:

a. Provide tapered transitions at changes in duct size and at connections to fans and other equipment.

b. Offset not more than 20°, on diverging flow and 30° on contracting flow, unless called for otherwise on drawing.

7. Elbows and Turning Vanes:

a. Use long radius, 45° and 90° fittings for all elbows and at tees, unless otherwise shown or space restrictions dictate use of square elbows.

1) Construct fittings with centerline radius equal to 1-1/2 times the duct width at the turn.

2) Where square vaned elbows are used, provide access doors as detailed below.

b. Turning Vanes: In all 90° turns in supply air ducts where 1-1/2 radius elbows cannot be used, install double radius turning vanes in square elbows.

1) Ducts 19” and Smaller: Use small double vanes with an inner radius of two inches (2”) and an outer radius of one inch (1”) mounted on 3/4” center.

2) Duct 19” and Larger: Use large double vanes with an inner radius of four inches (4”) and an outer radius of two inches (2”), mounted on three (3) 1/4” centers. Provide sound reduction type turning

vanes: “Airsan” Acoustiturn, by Air Filter Corporation, “Sone-Turn” by Sound Control Products Company, per SMACNA Plat 22, or equal.

3) **Provide 12” x 12” insulated access door into duct on both sides of each vaned fitting to facilitate duct cleaning.**

8. Flexible Duct:

a. Do not use flexible duct except where specifically called for on the plans.

b. At diffuser connections:

1) Provide duct listed as UL-181 Class I air duct and constructed in compliance with NFPA 90A.

2) **Minimum length 2.5 feet, maximum length 5 feet for supply ducts. Minimum length 2.5 feet, maximum length 5 feet for return air ducts. Install with not more than one (1) 90 full radius degree bend. Minimum and maximum lengths are to be closely followed since the flex duct acts as a main source of sound attenuation in the air system. Install with some slack in runout.**

3) Make joints with Nashua brand UL181A-P Duct Tape (Venture #1599B or Shurtape #PC857) and two (2) 1/2” wide positive locking straps, one on inner core and one on outer jacket. Use Panduit straps.

4) Minimum sound net insertion loss for duct as follows:

BAND, HZ	125	250	500	1000	2000
Loss dB/ft.	2.1	3.0	2.7	3.0	2.7

5) Submit sound and construction data for proposed alternates.

6) Tough vapor barrier reinforced metalized polyester jacket, tear and puncture resistant.

7) Airtight inner core with no fiberglass erosion into airstream.

8) **R-Value: 6.0 @ 75°F. mean temperature if within building insulation envelope, or R-value of 8.0 if outside building insulation envelope.**

c. **Do not use regular flex duct on exhaust systems. Final connections to exhaust air devices can be made with metal flex not to exceed 5’-0” in length.**

d. Manufacturers: **Atco 36 Series**, Certainteed, Thermoflex, Wiremold, Genflex, approved equal.

C. Medium Velocity Ductwork Systems:

1. Definition: Ductwork systems where duct pressures exceed two-inch (2") W.G. static pressure and/or duct velocities exceed 2000 fpm (all primary air ductwork to fan terminal boxes).

2. Ductwork Construction:

a. Construct all ductwork from fan discharge to terminal units using round duct fabricated from galvanized steel sheets in accordance with SMACNA High Velocity Standards, as indicated below:

1) All ductwork and fittings in the Mechanical Rooms.

b. Seal all transverse and longitudinal joints per SMACNA.

3. Round Ducts:

a. Construct round ducts from steel sheets of the following U.S. Gauge thickness, using the seam method shown.

b. Ducts up to 13" diameter; 24 gauge. Long or spiral seam.

c. Ducts 14" through 22" diameter; 22 gauge. Long or spiral seam.

d. Ducts 23" through 36"; 22 gauge. Spiral lock seam duct.

e. Ducts 37" through 50"; 20 gauge. Spiral lock seam duct.

f. Ducts 51" through 60"; 18 gauge. Longitudinal seam duct.

4. Seams and Joints:

a. Longitudinal Seams: Butt welded or lock-type joint.

b. Spiral Seams: Lock-type joint.

5. Fittings, Couplings and Other Joints:

a. Construct using minimum 22 gauge sheets. Spot weld along seams according to accepted trade practices.

b. Provide runout fittings, such as Y's, 45˚, 90˚, conical 90° with baffle as detailed on the runout fitting schedule. Design "tap-on" installation. Provide runout fittings requiring an orifice "built-in."

c. Make all connections using sheetmetal screws. Apply 3M Duct Sealer 800 (900 on 20" diameter and larger) to all joints to eliminate leakage and cover with UL181AP labeled duct tape, Nashau or approved equal. Use heat shrink factory fabricated joint sealer, "Thermofit" or approved equal as an alternate.

6. Flexible Duct:

a. Do not use flexible duct unless specifically called for on the plans.

b. Connection between main duct and terminal box.

1) Provide flexible duct listed as UL-181 Class I air duct and constructed in compliance with NFPA 90A.

2) Do not install more than four feet (4') of flexible duct between main and terminal box, using no more than one (1) 45˚ bend.

3) On insulated runouts, use insulated flexible duct, Thermoflex Type M-KH or approved equal. Fasten with 1/2" wide positive locking metal bands.

4) All ducts rate 10" W.G. minimum static pressure.

5) Manufacturers: Thermoflex, Wiremold, Genflex or approved equal.

D. Entire interior of ducts shall be thoroughly cleaned of all oil residue and dust prior to installing.

2.04 DUCT ACCESSORIES

A. Air Volume Controls:

1. Provide air volume dampers, or other control devices, at each low-pressure duct main and branch for a balancer to adjust the system to produce the air quantities shown.

a. Provide opposed blade damper for balancing in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.

2. Volume Dampers:

a. Flat sheet, single leaf damper with a continuous rod; damper leaf two (2) gauges (minimum 16 gauge) heavier than the duct where installed. Provide locking quadrants with indicators located accessible without demolition.

1) Use for supply, return and exhaust ductwork 14” round or 14” x 14”.

b. The locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided **with stand-off mounting brackets, bases, or adapters to provide clearance, between the duct surface and the operator, not less than the thickness of the insulation.** Stand-off mounting items shall be integral with the operator or a standard accessory of the damper manufacturer. All volume dampers indicated shall be provided with stand-off mounting brackets as required.

c. **All operators accessible and lockable. Do not insulate over top of volume damper operator handle.**

d. Locate dampers a minimum of 4 feet from diffusers.

3. Extractors:

a. Combination air straightening vanes and volume control with locking quadrant on outside or accessible through face of register.

b. Manufacturer: Titus AG-45 or approved equal.

c. Provide extractors at supply grilles attached directly to any main or branch duct serving more than one (1) grille.

4. Splitter Dampers:

a. Construct damper using sheetmetal blade hinge mounted inside duct.

b. Dampers or splitters shall be constructed from the same gauge metal as the ducts which they serve with a minimum of 22 gauge. Splitter length shall be 1-1/2 times the duct width up to 24” in size and above 24” in size shall be 1-1/4 times the duct width.

c. Attach Duro-dyne SRP-40 series splitter damper bracket to blade.

d. Connect 1/4” steel rod to damper bracket and extend through Duro-dyne SRP-14 ball joint damper casting mounting on outside of duct. Use 3/8” steel rod for splitter in ducts above 24” in size.

e. Install assembly for full swing of damper blade. Lock damper in proper position.

5. Opposed Blade Dampers:

a. Provide opposed blade balancing dampers with multiple blades equal to Greenheck VCD-15, 20-gauge frame and 16-gauge blade construction with synthetic axle bearings and 1/2” diameter operator, complete with 1” stand-off and manual locking quadrant as follows:

1) Use for outside air ductwork. Minimum damper size is actual duct size or 10” x 10”, whichever is larger. Provide transitions as required.

2) Use for supply, return and exhaust ductwork - 14” round or 14” x 14” and larger.

b. Damper material is to match ductwork material. (i.e., galvanized aluminum, stainless steel, etc.)

B. Gravity Backdraft Dampers:

1. Provide backdraft dampers counterbalanced to desired static pressure setting. Wide open static pressure drop not to exceed 0.15” W.G.

2. Damper blades aluminum with felt applied to tops of blades. Where dampers are exposed to outside temperature, provide neoprene edged blades.

3. Damper frames extruded aluminum; nylon bearings.

4. Assembly designed for operation at 20°F.

C. Access Panels and Doors:

1. Low Velocity System Access Panels:

a. Sheetmetal doors reinforced, cross-bracketed or otherwise stiffened to prevent rattle or vibration.

b. Seal doors airtight with felt edged gaskets.

c. Secure with hinges and sash locks.

d. Panels and doors for insulated duct systems are to be insulated.

2.05 GRILLES, REGISTERS AND DIFFUSERS

A. Provide grilles, registers, and diffusers of the types and sizes called for on plans and in schedule on drawings.

B. Finish with factory applied finish for extruded aluminum items, and with a prime coat for steel items. (Provide an additional factory baked enamel finish to match ceiling grid.) (Submit color sample for approval.)

C. Equip diffusers with panels of the proper size to match the suspended ceiling layout or with the proper frame for surface mounting. Fully correlate diffuser and grille style, dimension and fit with ceiling.

D. Manufacturers: Price, MetalAire, Titus, Tuttle & Bailey, Krueger, Anemostat, Carnes

E. All air devices located in damp areas are to be constructed from all aluminum components.

F. Provide minimum 12” deep externally insulated boot for sidewall type supply air devices.

G. Provide square to round transitions as required.

H. Provide minimum 12” deep (top duct tap) or 24” deep (side duct tap) externally insulated boot for return air and transfer air devices.

I. Provide minimum 12” deep boot for all exhaust devices.

2.06 LOUVERS AND HOODS

A. Provide air exhausts through building skin, as shown.

B. Louvers:

1. Size as shown; air pressure drop not to exceed 0.15” W.G. when handling 1150 FPM per square foot of free area.

2. Water penetration not to exceed .02 oz. per sq. ft. when handling 1150 FPM per square foot of free area.

3. 4” deep drainable louver constructed of .125” thick 6063-T52 extruded aluminum alloy with channel frame.

4. **Provide with 1/8” X 1/8” galvanized hardware cloth bee screen.**

5. Finish to be factory primed for field painting or applied .7 mil thick anodized dark bronze as directed by Architect.

6. Manufacturers: Greenheck ESD-403, Arrow, Carnes, Greenheck, Ruskin, Empco, Pottorff, or approved equal.

7. Any plenum or ductwork attached to louver is to slope to drain back through louver to exterior of building.

C. Hoods:

1. Construction of heavy-duty aluminum sheets with rolled interlocking seams with galvanized hood support members, similar to Greenheck Fabrahood or equal.

2. Provide with bee screen on outside air intake hoods and 1/4” x 1/4” galvanized bird screen on relief hoods.

3. **Curbs are to be a minimum of fourteen inches (14”) high above finished roof surface and match slope of roof.**

4. Manufacturers: Greenheck, Acme, Penn, Cook, Briedert and Carnes.

5. Provide 120-volt motorized damper.

2.07 AIR FILTERS

A. General:

1. All air filters to be listed as Class 2 by Underwriters Laboratory, Inc., Building Materials Directory.

2. All arrestance, efficiency (dust spot efficiency on atmospheric air) and dust holding capacities specified are to be in accordance with ASHRAE Standard 52-76.

3. Performance characteristics are to be verified by certified data published in manufacturer’s literature or by copies of current test data from an independent authorized test laboratory. Test data, where required, shall be an integral component of the manufacturer’s submittal data.

4. Provide and install one (1) clean set of filters in all air moving units that require filtration at completion of project.

B. Grease Rated Filters (for all return air filter grilles located in kitchens):

1. Media: Multiple layers of aluminum sheets that are corrugated, slit then expanded into a series of baffles. Media protected on both sides by expanded aluminum grid.

2. Initial Resistance: .06” W.G. at 350 fpm.

3. Frame: Single piece of heavy gauge two-inch (2") aluminum u-channel with "compression" flanges that grip the media and lock it to the frame.

4. Filter shall be washable.

5. Manufacturers: American Air Filter, mesh type grease filter or approved equal.

C. Disposable Panel Filters (for return air filter grilles and/or unit filter racks):

1. Media: Non-woven, lofted cotton bonded to 96% free area welded wire support grid. Not less than 2.45 square feet media area per square foot of filter face area. Arranged in radially pleated configuration and bonded continuously to inside perimeter of high wet-strength beverage board cell sides.

2. Cell Design: Two inches (2") deep with beverage board diagonal supports at entering air and leaving air faces of each cell.

3. Air Cleaning Performance: Minimum 25-30% efficiency 90-92% arrestance, MERV-8.

4. Initial Resistance: 0.2" W.G. at 500 fpm face velocity.

5. Dust Holding Capacity: Not less than 200 grams when operated at 500 fpm face velocity to a final resistance of .9 W.G.

6. Manufacturers: Cam-Farr Company Aeropleat II; AAF or approved equal.

D. Temporary Filters:

1. Reference 20 00 00, 3.07 for temporary filter requirements.

2.08 UNIT HEATERS (ELECTRIC)

A. Provide UL listed electric unit heaters with voltage, phase, number of steps, heating, and air delivery capacities, as scheduled. Suitable for vertical and horizontal mounting.

B. Casings fabricated of die-formed heavy gauge steel and finished in high gloss baked enamel.

C. Steel finned tubular element. Provide automatic reset thermal cutout for each element.

D. Individually adjustable discharge louvers.

E. Thermostat to match number of heater control steps. Wall mount or built-in as scheduled.

F. Provide angle support between unit heater threaded rod supports and nearest wall to prevent unit sidesway.

G. Manufacturers: Markel, Brasch, Modine, Trane, Berko or approved equal.

2.09 FIRE DAMPERS

A. Provide and install all fire dampers in all ductwork which passes a fire wall or fire rated ceiling as required by local building and fire safety codes.

B. All dampers folding blade type with no part of blade in the air stream.

C. Provide “out of wall or floor” type fire dampers where space restrictions or conditions dictate.

D. All fire dampers UL approved and of type required by NFPA 90A.

E. Install all fire dampers per manufacturer’s instructions. Installation detail must be submitted with damper submittal. **Post detail at job site in area of building permit**.

F. Provide UL rated sleeves and manufacturer supplied wall angles with damper.

G. Manufacturers: Ruskin, Air Balance, Arrow, Greenheck, Nailor or approved equal.

2.10 FIRE/SMOKE DAMPERS

A. Provide and install all fire/smoke dampers in all ductwork which passes through a smoke wall and/or any rated egress pathways, as required by local building and fire safety codes, and as indicated on the drawings.

B. All dampers shall have qualified electric operators.

C. Provide “out of wall or floor” type fire/smoke dampers where space restrictions or conditions dictate.

D. All dampers UL approved and of type required by NFPA 90A.

E. Install all dampers per manufacturer’s instructions. Installation detail must be submitted with damper submittal. **Post detail at job site in area of building permit**.

F. All dampers shall have a UL555S leakage classification of II.

G. Provide UL rated sleeves and manufacturer supplied wall angles with damper.

H. Provide four additional fire/smoke dampers to be sized and installed as directed by Architect.

I. Manufacturers: Ruskin, Air Balance, Arrow, Nailor, Greenheck or approved equal.

2.11 CORRIDOR CEILING FIRE SMOKE DAMPER

A. Provide and install appropriate corridor ceiling fire smoke dampers in all air devices located in ceiling portion of fire rated floor/ceiling and/or roof ceiling assemblies.

B. Damper must be classified as a **Corridor Ceiling Fire Smoke Damper**.

C. All dampers must be UL approved and of the type required by NFPA 90A.

D. Install per manufacturer’s recommendation, submit detail. **Post detail at job site in area of building permit.**

E. Manufacturers: Ruskin, Air Balance, Arrow, Nailor, Greenheck or approved equal.

2.12 CEILING FIRE DAMPER

A. Provide and install appropriate ceiling fire dampers in all air devices located in ceiling portion of fire rated floor/ceiling and/or roof ceiling assemblies.

B. Damper must be classified as a **Ceiling Fire Damper**.

C. All dampers must be UL approved and of the type required by NFPA 90A.

D. Install per manufacturer's recommendation, submit detail. **Post detail at job site in area of building permit.**

E. Manufacturers: Ruskin, Air Balance, Arrow, Nailor, Greenheck or approved equal.

PART 3 - EXECUTION

3.01 LOW VELOCITY DUCTWORK

A. Provide ductwork in accordance with SMACNA low velocity standards.

B. Provide backdraft dampers for all exhaust fans if motor operated dampers are not called for. Provide one-inch (1") mesh bird screen at all exhaust discharges.

C. Seal all transverse joints, seams, and fitting connections with KINGCO 11-376 "Super Seal" or "Ductmate Proseal", U.L. listed.

D. Where ducts exposed to view, pass through walls, floors, or ceilings, furnish, and install sheetmetal collars to cover the voids around the duct.

E. This work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job against noise, chatter, whistling or vibration and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner.

F. Duct shall be erected in the general locations shown on the drawings but must conform to all structural and final conditions of the building. Before fabricating any ductwork, the Contractor shall check the physical conditions at the job site, and shall make all necessary changes in cross sections, transitions, offsets, etc., whether they are specifically indicated or not at no additional charge to the Owner.

G. Reinforce all ducts to prevent buckling, breathing, vibration or unnecessary noise, such reinforcing to be as recommended in the SMACNA manual plus any additional reinforcing as may be required to meet job conditions.

H. Provide manually operated volume control dampers (with stand-off mounting brackets for externally insulated ductwork) in all branches, splits and taps for proper balancing of air distribution, whether shown on drawings or not, dampers to be either single blade or multi blade as shown in the SMACNA manual as required. They shall incorporate an indication device with lock to hold damper in position for proper setting.

I. Damper operators in all unfinished areas shall be Young Series 400 of the exact style, type and size required. All other operators shall be Young #315 and/or #896 opposite end from the operator. Where dampers are installed in ducts located above accessible type ceilings,

damper operators shall not be extended through the finished ceiling.

J. All square elbows shall have turning vanes per the SMACNA manual requirements.

K. Where ducts connect to fans, including roof exhausters, flexible connections shall be made using “Ventglas” fabric that is fire-resistant, waterproof, mildew-resistant and practically airtight, and shall weigh approximately thirty ounces per square yard. There shall be a minimum of two and one-half inches (2-1/2”) distance between the edges of the ducts. There shall be a minimum of one inch (1”) of slack for each full inch of static pressure on the fan system.

L. Furnish and install screens on all ducts, fans, etc. furnished by the Contractor which lead to, or are outdoors. Screens shall be 16 gauge, three-eighths inch (3/8”) mesh in removable galvanized steel frames.

M. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punches (not pin punches) and shall not be larger than necessary. All duct openings shall be provided with sheetmetal caps if the openings are to be left unconnected for any length of time. All panels of ducts twelve inches (12”) and larger shall be cross broken.

N. Furnish and install a minimum 16 x 16 x 2 internally insulated (foil facing to airstream) filter rack with a hinged type access door with cam or spring lock and filter in all unfiltered raw outside air ducts that connect directly to return air plenums.

O. **All ductwork that is connected to any exterior louver or wall cap, etc. shall be sloped to drain outside.**

3.02 DUCTWORK SUPPORTS

A. Support all ductwork to prevent sag, undue play, and swing. All horizontal ducts shall have a support within 2’ of each elbow and within 4’ of each branch intersection. Provide a hanger within twelve inches (12”) from unit supply and return. Return air plenums on back of air handling units must have a minimum of four (4) support straps.

B. Low Pressure Ductwork:

1. Duct 40” and Less: Provide with 1” x 18-gauge straps fastened to ductwork, and to building construction. Space not more than eight feet (8’) on center. Hanger straps shall lap under duct a minimum of one inch (1”) and have a minimum of one (1) fastening screw on the bottom and two (2) on the side.

2. Ducts Over 40”: Provide mild steel threaded rods fastened to angle iron supports under duct with nuts and to building construction with appropriate inserts, flanges or clamps. Space not more than four feet (4’) on center with rods and angle supports as follows:

Angle Length	**Angle**	**Rod Dia.**
4’-0”	1-1/2” x 1-1/2” x 1/8”	1/4”
6’-0”	2” x 2” x 1/8”	1/4”
8’-0”	2” x 2” x 1/8”	3/8”
10’-0”	3” x 3” x 1/8”	3/8”

C. Vertical ducts supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles.

D. Recommend methods of fastening bracing to ductwork, including riveting, bolting and tack welding.

E. All flex duct runouts must be properly supported. Use minimum twelve (12) gauge wire with 8" long saddle that fits up to mid-point of duct for support of flex duct. **Web Type fabric duct support is strictly prohibited**. Maximum permissible sag is 1/2" per foot of spacing between supports.

F. Provide 1" x 20-gauge straps, minimum 8' - 0" o.c. for all round sheetmetal runouts that are 18" in diameter or less (except Spiral Ducts).

G. Spiral ductwork is to be supported with 2" x 18-gauge strap bands around duct with a 3/8" bolt and nut connection at top. Connect to structure with minimum 3/8" all thread rods, minimum 8'-0" o.c.

3.03 ACCESS

A. Furnish all fans with consideration of location of motor and drive.

B. Furnish and install in the ductwork, hinged access doors to provide access to all manual and automatic dampers, fusible links, cleaning operations, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. In rectangular ducts larger than twenty inches (20") in their smallest dimension, install access doors every twenty feet (20'). Where the size of the duct permits, the doors shall be eighteen inches (18") by sixteen inches (16"). Factory fabricated doors as manufactured by Milcor meeting these specifications will be acceptable. Access doors shall be submitted for approval.

C. Each fire damper door shall have a label with letters not less than 1/2" in height reading "**Fire Damper**", "**Corridor Ceiling Fire Smoke Damper**" or "**Fire/Smoke Damper**" (as applicable).

D. Cycle damper after installation to insure free movement. Seal opening around fire damper with non-combustible material to maintain integrity of one (1) hour fire wall.

E. Provide access door in supply air and return air drops from rooftop units. Access door to be in accessible location directly above first elbow. Access doors to be 18" X 18" minimum where duct size allows. Access doors shall be shown on ductwork shop drawings.

F. Provide access doors for maintenance inspection and cleaning in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.

3.04 Fully coordinate and work directly with the Balancing and Testing Agency to provide all systems in perfect operating order. Make corrections and adjustments as required by the Balancing and Testing Agency in a timely manner.

3.05 For Each Dryer: Provide 4" diameter or 5" x 3" rectangular flue pipe up through the wall and ceiling cavity and terminate into Briedert Cap. Provide transitions as required. Provide 4" diameter tie in point for residential type dryer or stacked washer dryer as required.

3.06 **CAP OPEN ENDS OF ALL DUCTS (INCLUDING SPIN-INS) AND EQUIPMENT WITH MINIMUM FOUR (4) MIL. PLASTIC TO PREVENT CONSTRUCTION DEBRIS AND DUST FROM ENTERING OPENINGS AT ALL TIMES DURING CONSTRUCTION.**

END OF SECTION

SECTION 26 05 00 - GENERAL

PART 1 – GENERAL

1.01 SCOPE OF WORK

Unless otherwise specified, provide all labor, equipment, supplies, materials, superintendence and testing necessary for the installation of complete electrical systems as required by these specifications and as shown on the Drawings, subject to the terms and conditions of the contract. Complete such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the Drawings. Include empty conduits as required for all special systems and power for condensate pumps and HVAC control panels as required by the Mechanical Contractor. Field coordinate exact locations.

A. Submit a bid on the basis of a complete installation, including all labor, material, cartage, insurance, permits, associated fees and taxes.

B. Include temporary electrical power and lighting that will be required for the interior of the buildings. Provide lighting to satisfy OSHA requirements and the NEC.

C. All Agreement Forms, General Conditions, Supplementary Conditions, and Division 1 of the specifications shall apply to the work specified in Division 26-28.

D. Additional Site Visit Costs: The Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.

E. No attempt has been made to show complete design details of building construction on the Electrical plans. Refer to Architectural, Structural and Mechanical plans for additional details which will affect electrical work. No extra cost will be allowed for offsets in conduit and wiring to avoid other work or when minor changes are necessary to facilitate installation or maintenance.

F. Electrical Contractor is to provide all parts and labor to make final connections to all equipment shown in contract documents. Power may be shown in general location, it is expected that Electrical Contractor coordinate final locations for rough-in and connection requirements with exact equipment being installed. These items include but not limited to book security, exhaust fans, kilns, hand dryers, sensor operating plumbing devices, overhead doors, powered curtain, fire alarm door hold opens, etc.

G. **NO TOXIC NOR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED.**

H. **REMODEL WORK**: Coordinate all connections of new equipment with existing services (voltage, phase, etc.). While Architect and Owner may have dictated phases on contract documents, means and methods to accomplish phasing is considered the Contractor's responsibility and is not necessarily shown on contract documents. As required, Contractor shall provide for all temporary power, for all components required to remain in service during construction, to suit the Contractor's planned phasing for remodel work, this includes all time between the start of the project and the final installed condition, as shown in the documents. While every effort has been made on contract documents to make construction phasing smooth, Engineer may not know final phasing plan at time of documents. Contractor shall provide allowances for their implementation of phasing. No additional funds will be made

available for Contractor's implementation of the final phasing plan. Contractor shall furnish and install all equipment, materials and incidental items required to make system complete and operable for the duration of the project. If the Contractor has alternate solutions for phasing to save cost, the approach should be brought to the attention of the design team prior to implementation.

I. An extra copy of all field reports shall be kept in a separate notebook. Contractor to set up in the Construction Manager's trailer. These reports shall be used for Contractor to check that each individual item noted has been completed. Also keep log of where extra receptacles and outlet boxes called out in 26 27 26, 3.01 and 26 05 80, 2.01. are installed.

J. **Electrical Contractor shall use Fire Alarm Contractor's Shop Drawings and Rough-In details on drawings for rough-in of all fire alarm devices. Any devices not roughed-in according to Fire Alarm Shop Drawings and drawing details shall be relocated at no cost to Owner.**

K. Sensor Operated Plumbing Devices: Plumbing Contractor to provide transformers from manufacturer. Electrical Contractor to provide all other electrical materials and labor to provide complete and workable device. This includes but is not limited to receptacles for plug in transformers, line voltage wire/conduit for direct connect low voltage transformers, all low voltage plenum rated 16-gauge wire.

L. **Cad Drawings:**

1. **Architectural Background Files – Architectural Files are background files; MEP drawings are not background files.** To insure the most current Architectural files are used for shop drawings backgrounds, they must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

2. **MEP Drawings** – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested, they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of $500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.

3. **MEP CAD Files that will be released.**

   a. If no Architectural RCP is available for light locations, Lighting Floorplans will be released.

   b. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.

c. Fire Alarm/Fire Sprinkler/Intercom etc… Contractors must use Architectural Revit Models and CAD files for backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. This must be obtained from Architect. Engineer may not release architectural drawings.

4. Reference **"HCE BIM Protocols"** – document attached to the end of this section. It defines the expectations, limits and level of development of any 3D design tool, (if used) for any portion of a project design, to develop 2D bid documents. This applies to 3D design tool used by design teams as well as 3D design tool that may be requested by Contractor.

M. **Site observation communication between Engineer and Contractors will be using online software. Contractors required to obtain a Fieldwire Pro Software License of other software license required by MEP Engineer for the duration of the project. This software will be used to generate and respond to Field Reports. Contractors required to carry license for duration of project. Reference 3.12.**

N. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner hereto in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract, or sublet it as a whole, without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.

O. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures and for coordinating all portions of the Work under his Contract.

P. The Contractor shall provide, without extra charge, all incidental items required as a part of the Work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.

Q. Provide a completed Schedule of Values, see Specification Section 26 05 10. Preliminary schedule of values shall be submitted to Architect/Engineer for review.

1.02 SITE INSPECTION

A. Prior to Bidding, the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.

B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of

these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative, herewith or otherwise, shall be complied with in every respect.

B. Provide electrical connections and service to items described in all other sections of these specifications.

C. The Electrical Contractor shall provide all wiring and connections required to fire/smoke dampers. Coordinate exact locations of dampers with Mechanical Contractor and relay requirements with Fire Alarm Contractor.

D. The Electrical Contractor shall provide all wiring and connections required to backdraft dampers at exhaust fans. Coordinate exact locations of dampers with Mechanical Contractor.

E. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.

1.04 WORK NOT INCLUDED

A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.

B. Unless otherwise indicated, motors shall be furnished by others, but connected by the Electrical Contractor as indicated on the Drawings.

C. Unless otherwise specified, Mechanical equipment control low voltage wiring (less than 50 VAC) shall be provided and installed by the Mechanical Contractor.

1.05 SPECIFICATION TERMINOLOGY (Definitions)

A. "Provide": Includes all material, installation, labor subcontracts, appurtenances and mark-up required for a complete operable system as shown and specified, set in place, connected and ready to use.

B. "Furnish": Purchase and deliver to job site, material as shown and specified.

C. "Install": Includes all installation, labor subcontracts, appurtenances and mark-up required for complete installation of equipment furnished by others.

D. **"Record Drawings": Drawings that reflect the electrical systems as actually constructed by the Contractor including conduit routing.**

E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. All clearances per NEC.

F. Wherever the term “shown on drawings” is used in the specifications, it shall mean “noted”, “indicated”, “scheduled”, “detailed”, or any other diagrammatic or written reference made on the drawings.

G. “Conduit” includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit system.

H. “Concealed” means hidden from sight in chases, furred spaces, shafts, hung ceilings, imbedded in construction, crawl spaces, etc.

1.06 DIAGRAMMATIC DRAWINGS:

A. The drawings are in general diagrammatic, and the location of outlets, switches, motors, etc., on the drawings does not necessarily mean that such units shall be placed at that exact spot, as scaled on the drawings, but shall be located to function best. Use the drawings, and these specifications for guidance and secure the Engineer’s approval of all changes in location. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.

B. Verify all measurements at the site. No extra compensation will be allowed because of differences between locations shown on the drawings and measurements at the building.

C. The Contractor is to draw electrical rooms and service to scale **(1/4” minimum)** with actual equipment to be used and submit to the Engineer prior to installation. The Contractor must ensure that all minimum NEC working clearances are maintained. Coordinate with equipment of other trades.

D. Where lighting fixtures and other electrical items are shown in conflict with structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.

E. The branch circuits and arrangement of home runs have been designed to compensate for voltage drop and other considerations to accomplish maximum economy. Re-circuiting will not be permitted without specific approval. **Circuit numbers may change to achieve balanced loads on panels.**

F. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

G. Drawings and specifications are complimentary each to the other. What is called for by one shall be as binding as if called for by both.

H. Should the drawings disagree in themselves, or with the specifications, the better quality or greater quantity of work or materials shall be used.

I. Outlets and switches obviously placed in a location not suitable to the finished room or area shall be removed and relocated when so directed by the Architect at no cost to the Owner. The Architect shall have the right to make any reasonable change in outlet locations before rough-in without additional cost to the Owner. The contractor shall contact engineer when switches are inadvertently shown on hinge side of door prior to rough-in.

J. Location of light fixtures shall be coordinated with reflected ceiling plans and/or room finish schedules.

1.07 MATERIAL AND EQUIPMENT SUBMITTALS

A. Submittals: Provide submittals for all products and systems described in Division 26-28 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.

B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) submittal number will be returned and required to be broken into unique separate submittal numbers.** The Engineer's check will be general and does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.

C. Submittal Review Time – In order to provide the most efficient submittal review and to cut down delays of equipment with long lead times, the Engineer requests the Contractor Provide a Submittal Schedule at the beginning of the job. At the beginning of the project the contractor is to review job schedule and material lead times. Based on that information the Contractor shall put together a reasonable schedule of dates that each submittal is needed to be returned in order of importance, to order materials. ALL submittals, with separate covers and identifiers shall be submitted to the design team as early in the projects as possible. The design team can NOT practically review ALL submittals at once in 2 weeks, but the design team can schedule review time for all submittals in priority order, based on the Contractor provided Submittal Schedule, to be returned to contractor prior to the requested schedule date from the contractor. Submittals that are haphazardly submitted late in the project cycle creating artificial time emergencies are not the responsibility of the Engineer to provide unreasonable expedited review. Complicated submittals require extended review time, and this should be taken into account. Submittal review time requested only applies to standard workdays, and excludes weekends and holidays. Extended company holidays are typical at Thanksgiving Wednesday-Friday and the final 2 weeks of the year at Christmas and New Year, our office is closed. These times frames should be considered while producing the required Submittal Schedule.

D. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**

E. **Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.**

F. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section. Separate PDFs for each Submittal number.**

G. **HARDCOPY SUBMITTAL REQUIREMENT: Hardcopy submittals will not be required by Engineer.**

H. **PDF SUBMITTAL REQUIREMENT:**

For submittal sections listed below as allowed pdfs, the following requirements must be met, or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected.**

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays caused by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

I. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc. will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**

J. **Submittals will be returned in order of construction of the project, not necessarily in order submitted**. If all sections are submitted under one binder/at one time and transmittal, each section will be returned at the appropriate time for construction phasing. Electrical Gear will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Electrical Gear and Light Fixtures may require extended review time. **If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.**

K. **DO NOT submit the following sections unless deviating from the schedules/specifications. Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications, submittal will be required. (Deviations must be noted on Transmittal and Highlight items in each submittal content that are different to allow for proper review.):**

1. 26 05 00 – General Provisions
2. 26 05 10 – Schedule of Values
3. 26 05 19 – Wire and Cable
4. 26 05 26 – Grounding and Bonding
5. 26 05 29 – Hangers and Supporting Devices
6. 26 05 33 – Raceways

7. 26 05 34 – Outlet Boxes, Pull Boxes and Junction Boxes

8. 26 05 80 – Empty Raceway Rough-In

9. 26 27 26 – Devices

10. 26 28 15 – Safety Disconnect Switch

11. 26 28 16 – Fuses

12. 26 28 25 – Contactors

L. **PDF Submittals Allowed** for Product Cut-Sheets are limited to the following items:

Separate PDF file for each Submittal number is required. Follow file format above.

1. 26 05 00 - Mechanical/Electrical Coordination Sheet

2. 26 05 00 - Plumbing/Electrical Coordination Sheet

3. 26 51 00 – Interior Lighting System

4. 26 56 00 – Exterior Lighting System

5. 28 46 00 – Fire Alarm System - (Product Data and Shop Drawings)

M. When requested, present samples of all materials proposed for use to the Engineer for his approval.

N. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.

O. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility and submit to the Engineer for approval.

P. **Substitutions**: ("Substitution Request" form must be submitted)

1. Substitutions must be made and accepted PRIOR to Bid.

2. Unless otherwise indicated, base bid on the equipment shown on the Drawings and hereinafter specified.

3. Request for approval to substitute materials, methods, or processes shall be made to Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.

4. All substitutions shall be of equal or better quality to the equipment specified.

5. Acceptance of the substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and completion of work on schedule.

6. It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer, or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity and other characteristics unless no substitutions are noted.

7. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution requests will be automatically rejected.**

8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**

    a. Light Fixtures Packages

    b. Alternate Transformers

    c. Alternate Surge Protective Devices

    d. Alternate Equipment/Gear Packages

    e. Contractor Cost Savings Packages Requiring Substantial Review Time

1.08 SHOP DRAWINGS REQUIRED

A. Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination.

B. Architectural drawings must be used for backgrounds in preparation of shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01-L.

C. Reference other specification for additional requirements.

    1. Fire Alarm

    2. PA System

    3. Electrical Rooms

1.09 RECORD DRAWINGS

A. Reference requirements stated elsewhere in the specifications.

B. THE CONTRACTOR SHALL TAPE ALL ADDENDAS ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THIS REQUIREMENT IS MET.

C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the site construction office as the work progresses. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Indicate locations of all existing active and inactive conduit uncovered during construction. **Keep marked up set at site for review at site meetings.**

D. **Contractor to indicate conduit routing locations for all major runs and branch circuits under slab along with major junction locations.**

E. The Contractor shall be responsible for updating all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to “As-Built” conditions. At the completion of the job the marked up As-Built Drawings shall be submitted to the Architect for final review and comment. These corrected prints together with all the revisions, additions, and deletions of work, shall form the basis for preparing a set of record drawings.

F. Using the “Record Drawing Set”, the Contractor shall print two (2) complete sets of prints, one for submission to the Owner and one rolled in a 4” PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contactor shall provide pdf copies/scans for owner record purposes. Remove Engineer’s seal from record drawings.

G. The Contractor shall bear all the costs of producing the “Record Drawing Set”.

H. Electrical riser diagrams shall be laminated and mounted in the main electrical room or as directed by the Engineer.

1.10 CODES, REGULATIONS AND ORDINANCES

A. Comply with the requirements of the National Electrical Code, National Electrical Safety Code, Occupational Safety and Health Act (OSHA) and all other applicable Federal, State, and local codes and ordinances. All codes and standards shall be per the latest adopted edition with all supplements and official interpretations included. Provide disconnecting means for all equipment per NEC. The Drawings and specifications take precedence when they are more stringent than codes, standards, ordinances, and statutes take precedence when they are more stringent or conflict with the Drawings and specifications.

B. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.

C. All work shall also satisfy applicable local codes, ordinances, and regulations of the governing bodies, and all authorities having jurisdiction over the work. Where alterations to, or deviations from, the drawings and specifications are required by the authority having

jurisdiction, report the same in writing to the Owner's representative and secure his approval before proceeding.

1.11 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

A. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.

B. Retain all portable and detachable parts or portions of installation such as fuses, key locks, adapters, blocking clips, and inserts until final completion of work. Deliver parts to the Owner or his authorized representative and attach an itemized receipt to obtain request for final payment.

C. Product Handling:

1. Use all means necessary to protect the work and materials of this section before, during, and after installation and to protect the work and materials of all other trades.

2. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3. Store and protect materials and equipment in accordance with the manufacturer's recommendations.

4. Provide suitable box or crate electrical equipment and cover with waterproof covers to protect against dirt, moisture, or accidental damage during shipment or outdoors at the job site.

5. Store all conduits on skids.

1.12 SERVICEABILITY OF PRODUCTS

A. Furnish all products to provide the proper orientation of serviceable components to access space provided.

B. Coordinate installation of piping, ductwork, equipment, conduits, junction boxes, panels, and other products to allow proper service of all items requiring periodic maintenance or replacement.

C. Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.

1.13 ACCESSIBILITY OF PRODUCTS

A. Arrange all work to provide permanent, convenient, and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

B. Provide access doors in ceilings, walls, floors, etc. for access to automatic devices and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.14 UTILITY COSTS

A. Provide complete utility service connections. The locations and elevations of the various utilities included within the scope of this work have been obtained from city and/or other substantially reliable sources as a general guide only, without guarantee as to accuracy. Verify the locations, elevations, and availability of all utilities and services required, and be adequately informed as to their relation to the work.

B. Include all service charges required by the electric utility or telephone/data/cable utility. Reference General Conditions for further information. Keep all utility company charges as a separate line item in bid. If cost is not available from utility company, indicate utility contact person, telephone number and **date of contact**.

1.15 CLEAN-UP

A. Remove debris and waste materials from within the construction areas and transport off-site, daily.

B. Keep the construction area clean, free from hazard, and orderly arranged.

C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.

D. Dispose of waste materials in accordance with all regulations which govern.

E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.

F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.

G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion, and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Unless otherwise indicated, provide only new equipment and materials.

B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.

C. All materials furnished under these specifications shall be the standard product of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.

D. Guarantees:

1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and the Contractor may have by law or by other provisions of the Contract Documents. In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect, and shall remain in effect for a period of ONE (1) YEAR thereafter.

2. All materials, items of equipment, all lighting, and workmanship furnished under each section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any contract, due to defective or improper material, equipment, workmanship, or design which may develop, shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.

5. Furnish, before the final payment is made, a written guarantee covering the above requirements.

6. Reference other guarantee information elsewhere in these specifications.

E. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25, and a smoke developed index of not more than 50, when tested in accordance with ASTM E 84.

2.02 STANDARDS

A. Where the Underwriters' Laboratories (UL) have established standards and issued labels for a particular group, class or type of material, apparatus, appliance, or device, provide the UL label on all such items in that category incorporated into the work.

B. Where such items are not covered by UL standards, they shall meet or exceed the requirements of the current National Electrical Code (NEC), or if not covered there, by the applicable, published, recognized standard of the American National Standards Institute (ANSI), or of the industry and of the related engineering society. Example: National Electrical Manufacturers Association (NEMA) and Institute of Electrical and Electronics Engineers (IEEE).

C. Contractor is to follow the most current version adopted for all codes and standards.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

A. Carefully lay out all work in advance so as to minimize cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, etc. Perform all cutting, channeling, drilling, etc., as required for the proper support, concealment, installation, or anchorage of raceways, outlets, or electrical equipment in a careful manner. Any damage to the building, structure, piping, ducts, equipment, or defaced finish, tile, plaster, woodwork, or metal work shall be repaired by skilled mechanics of the trades involved at the Contractor's expense and to the satisfaction of the Engineer. All cutting, channeling, chasing, or drilling of unfinished masonry, tile, etc., or cutting, drilling, anchoring to or welding of structural members shall be performed in a manner having the Engineer's prior approval. All openings made in fire rated or smoke rated walls, floors, and ceilings shall be patched and made tight in a manner to conform to the fire rating or smoke rating for the enclosure.

B. Where conduits pass through exterior walls, thoroughly caulk with sealant the annular space around the conduit to provide a watertight closure at the interior wall cavity and exterior wall surface. Provide ¼" maximum annular space around the conduit. Provide and install all counterflashing of all conduit, pipe and supports which pierces roofs and other weather barrier surfaces. Verify detail with Architect before installation. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at his expense, to Architect's satisfaction. All waterproofing, flashing and counterflashing shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect and Roofing Contractor.

3.02 SEALING AND FIREPROOFING

A. SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.

1. Only materials tested in the specific UL System No. may be used.

a. Caulk Manufacturer:

1) 3M Type CP-25 W/B + for all assemblies requiring 3M caulk.

2) For WL3045 and WL3046 use Hilti FS611A sealant.

b. Steel Sleeve (stud wall) (UL System No. WL1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum two-inch (2") lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus one inch (1") such that, when installed, the ends of the sleeve will project approximately 1/2" beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with conduit) to be 2 to 2-1/2" larger than the outside diameter of conduit such that, when the steel sleeve is installed, a 1 to 1-1/4" annular space will

be present between the steel sleeve and the conduit around the entire circumference of the conduit. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.

c. Optional Steel Sleeve (concrete or block wall): Except for single insulated cables, provide sleeve cast in floor/wall or mortared into CMU wall; Schedule 40 or heavier, length to extend a maximum one inch (1") from top surface of floor or a maximum of one inch (1") from both sides of wall.

d. Forming Material: Minimum one-inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.

2. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies and one (1) side of floor.

3. Alternate floor penetration system (with firestop mortar): UL System No. CAJ1032.

4. Wires and Cables:

a. For gypsum frame wall, single cable: Fireproof per UL System No. WL3001. Opening for cables to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).

b. For gypsum frame wall, multiple cables: Use UL system No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.

c. For concrete walls/floors or CMU walls, single or multiple cables: Fireproof per UL System No. CAJ3030. Install sleeve in assembly flush with both sides. Cables to be a minimum of ten percent (10%) and a maximum of thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.

5. Reference Architectural for the exact location of all rated walls, floors, ceilings, and ceiling/roof assemblies.

6. Materials used in firestop systems shall be installed in accordance with the manufacturer's written instructions (shall be posted at job site, in General Contractors trailer), provided with materials for specific UL System No.

7. Manufacturers: 3M, Metacaulk, Hilti, BioFireshield or equal.

B. In non-rated walls identified for sound insulation, provide 1/2" space between conduit and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.

C. **Final condition to prevent passage of fire, smoke, noxious gas, and water.**

D. For non-rated electrical/mechanical rooms: Seal all conduit passing through room walls, floors and ceilings with 3M caulk, Type CP-25 WB+.

3.03 WORKMANSHIP AND COMPLETION OF INSTALLATION

A. For the actual fabrication, installation, and testing, use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturer's recommended methods of installation. In acceptance or rejection of the installed work, no allowance will be made for lack of skill on the part of workmen.

B. Install all specialties as detailed on plans. Where details or specific installation specifications are not included herein, follow approved manufacturer's recommendations.

C. Install complete, thoroughly check, correctly adjust, clean, and leave ready for operation all equipment and material connected with this project.

D. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

E. Electrical service stub locations, sizes and quantities for equipment are approximate only. The Contractor must verify all service locations, sizes and quantities with the equipment supplier before rough-in.

F. The Electrical Contractor shall make all final connections to all electrical equipment furnished and set in place by others, including millwork with outlets. The Electrical Contractor shall provide and install all disconnect switches as required.

G. The Electrical Contractor shall provide/install all circuit breakers, power wiring, conduit systems and final connections required for operation of heating cable systems.

H. Provide and install all adjustable mounting brackets, steel bar hangers, T-bar mounting clips, support channels and universal support bridges as required for installation of recessed light fixtures, speakers, alarm devices and other ceiling mounted devices. Ceiling tile shall not be used to support ceiling mounted devices in lay-in ceilings.

I. Provide wood trim for any semi-recessed panels installed. Verify finishes with the Owner/Architect.

J. Provide Hoffman enclosure (#A-244208WFLP) wall mounted at location shown on plans. Provided in enclosure shall be spare fuses, three (3) of each amperage used in project up to 100-amp size and spare smoke detectors (see Section 28 46 00.)

K. Equipment and materials shall be listed by an organization that evaluates products and states that the equipment or material, either meets appropriate designated standards or has been tested and found suitable for a specified purpose or shall be labeled by the manufacturer to indicate compliance with appropriate standards or performance in the specified manner to be used.

1. Listed or labeled equipment and materials shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned in accordance with any instructions included in the listing or labeling.

L. The installation shall be performed by licensed, competent workmen to provide a thorough and complete installation.

M. All work shall be accomplished in conjunction with other trades in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.

N. Exact locations shall be determined by reference to the general plans and measurements at the building and shall be subject to reasonable change by the Owner's representative without additional cost.

O. Prior to and during construction, provide adequate storage facilities and properly protect items subject to any damage. Failure to comply with this provision will be sufficient cause for the rejection of the particular apparatus involved.

P. At completion, the installation shall be thoroughly cleaned. All tools, equipment, obstructions, temporary power, temporary lighting, and debris shall be removed from the premises.

3.04 BALANCING SYSTEM

A. Balance the electrical system between the respective phases of the system. Balance individual circuits in each panel of the system. Where phase assignments or circuit numbers are indicated on the drawing, do not deviate without the Engineer's approval. All deviations shall be noted on panelboard submittals and on Record Drawings and schedules.

3.05 COOPERATION WITH OTHER CONTRACTORS

A. Cooperate with other Contractors so that the installation of the electrical materials and equipment may be properly coordinated. Where a conflict occurs with piping, duct work, etc., it shall be resolved as directed by the Engineer.

B. Interferences between conduit and other trades shall be handled by giving precedence to pipelines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed:

1. Building Lines
2. Structural Members
3. Drainage Waste and Vent Piping
4. Refrigerant Piping
5. Ductwork
6. Water and Gas Piping
7. Electrical Conduit
8. Fire Protection Piping

3.06 COORDINATION OF WORK

A. Each Contractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing inter-related work. Before installation, all Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.

B. Locations of conduit and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of systems shall be determined prior to fabrication or installation.

C. Offsets and changes of direction in all conduit systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.

D. Where discrepancies in scope of work as to which Trade provides items such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems.

E. Verify voltage, phases, termination points, termination requirements and required disconnects for all equipment provided as part of this contract or equipment furnished by Owner prior to rough-in. Report any discrepancies to Architect/Engineer.

F. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.

G. **The Electrical Subcontractor shall verify with HVAC, Plumbing and Fire Protection Subcontractors the required electrical characteristics for all motors and equipment before ordering and submitting of electrical gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.**

3.07 SAFETY PRECAUTIONS AND PROGRAMS

A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

3.08 OPERATING AND MAINTENANCE MANUALS

A. Provide one (1) Operation and Maintenance manual for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records.

B. Operating Sequence and Procedures:

1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter.

2. Typewritten Operating Procedures: Write procedures for start-up, operation, and shutdown.

a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.

3. Shutdown Procedures: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

C. Maintenance Instructions:

1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.

D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide the nearest manufacturer's representative's name, address and phone number.

E. Shop Drawings: Provide two copies of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturer's brochures or properly identified in a separate subsection.

F. Spare Parts Lists: Include a list of all equipment furnished for the project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or systems. Properly identify each part-by-part number and manufacturer.

G. Lighting Controls Factory Start Up Report shall be included in O & M Manuals.

3.09 IDENTIFICATION

A. Equip the following items with nameplates:

1. Motor Starters

2. Main Switchboard and Overcurrent Devices and Spares

3. Panelboards and Branch Circuits

4. Safety Disconnect Switches

5. Contactors

6. Control/Power Equipment in Separate Enclosures Including Relays

7. Bypass Switches and Transfer Switches

8. Emergency Generator Sets

9. UPS System and Battery Racks

10. Motor Control Centers

11. Transformers

B. No dymo (stick on indented plastic) type label will be permitted.

C. Identify equipment listed above. COORDINATE EQUIPMENT NUMBERS WITH MECHANICAL AND/OR KITCHEN PLANS. Each piece of equipment shall be numbered consistently throughout.

D. Fabricate nameplates as follows:

1. Provide three (3) ply, 1/16” laminated plastic nameplate material with white core for lettering and black background. All nameplates, for equipment powered from emergency circuits, shall have white core for lettering and red background.

2. Use capital letters.

3. Unless otherwise indicated, provide minimum 3/4” high x 2” long nameplates with 1/4” letters.

4. All labels shall be permanently affixed to the front of all required equipment using two (2) round head self-tapping screws. Self-adhesive labels are not acceptable. Align labels with equipment.

E. All junction boxes shall have the panel/circuit number(s) identified on the blank coverplate, handwritten with a permanent black marker. Disconnects, combination motor starter/disconnects, and manual motor starter shall have the panel/circuit number(s) identified on the inside of the front cover, handwritten with a permanent black marker.

F. Provide engraved coverplates for all switches and control devices which are not otherwise clearly related to the equipment they serve.

G. **Label all receptacles and light switches with circuit number using electronic labeler (black on clear). Install label level on front of face plate for receptacles and back side of face plate for light switches.**

H. Spray paint J-Boxes red for Fire Alarm System. All other special systems J-Boxes to be painted white.

I. Color code all 600 volt insulated conductors by installing conductors with factory colored insulation for conductors No. 10 AWG and smaller.

J. Install colored tape on all 600-volt conductors No. 8 AWG and larger. Apply tape 6 inches from terminal points. Do not cover factory applied cable identification markings with taping; tape locations may be adjusted slightly to prevent the covering of factory markings. Tape shall be Scotch No. 35 or approved equal, 7-mil thick by 3/4" wide vinyl adhesive tape.

K. Install engraved plastic laminate nameplates as listed below.

EQUIPMENT	LETTERING SIZE	INFORMATION
Switchboards, Panelboards, MCCs and other distribution system overcurrent devices	1/4" / 1/8"	Switchboard name designation, ampere rating of the supply conductors, voltage characteristics, power source and room number(s). EX: MDP, 1900A, 480Y/277V, Served from Utility EX: HVA, 175A, 480Y/277V, source DP-1,3,5. in Room 100.
Transformers	1/4" / 1/8"	Transformer name designation, load served, power source and room number(s). EX: Trans. TR-1, serves PANEL LV-1, source DP-7,9.11 in Room 203.
Remotely mounted Safety Switches and Starters	1/8"	Load served, power source and room number(s). EX: HWP-1, HVA 37,39,4 1 in Room 203. EX: PANEL LV-2 in Room 303, source TR-2.
Contactors	1/8"	Load served, power source and room number(s). EX: Room 502, Science Lab, LVA 31,33 35, 37,39,4 1. EX: Building security lights, HVA 2, 4. EX: Parking lot lights, HVA 6, 8, 10.

L. Prepare a neatly typed panelboard circuit directory. Identify all circuits by the equipment served and by the room number, room numbers may be different from those shown on drawings. Verify room numbers prior to typing directories. Indicate spares and spaces with light, erasable pencil marking.

3.10 TESTING

A. Test and record results for all power feeders for Megger Readings, including phase to phase and phase to ground as recommended by the cable manufacturer.

B. Measure and record service ground resistance.

C. For equipment having ground-fault protection, the ground-fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions which shall be provided with the equipment. A written record of this test shall be made and shall be submitted to the Engineer and a copy put in the Operation and Maintenance Manuals.

3.11 CERTIFICATE OF COMPLETION

A. Submit, at time of request for final inspection, a completed letter in the following format:

1. I, (Name) , of (Firm) , certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of (Date). I further certify that the following specification requirements have been fulfilled:

2. Megger readings performed, pdf copy of logs attached.

3. Ground tests performed, pdf copies of method used and results attached, including service ground readings and ground fault test results.

4. Operating manuals completed and instructions of operating personnel performed for all systems, (Date) , (Signature, Owner's Representative).

5. Record drawings up-to-date and ready to deliver to Engineer.

6. Fire alarm system final connections, check-out and start-up completed on (Date) by (Signature, Factory Authorized Representative and Trained Technician) .

7. Gear Coordination Study.

8. Ground Fault Settings Completed and Documented, pdf attached.

9. Factory Lighting Control Start-up, Completed pdf attached.

10. Factory Transformer/SPD Start-up Completed pdf attached.

11. Factory Generator/ATS Start-Up Completed pdf attached

12. All other tests required by Specifications have been performed.

13. Final clean-up is completed.

14. All systems are fully operational.

◊ Signed: _____

3.12 SITE OBSERVATION

A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must respond to each item listed on each field report in writing, item by item. Large projects may break up site walks by area, project must be 75,000 sqft or larger to request multiple site trips for same type of inspection. Minimum sqft size of divided inspection should be 30,000 sqft or larger.

B. **Contractor Readiness Forms:** Contractors are to complete all Contractor Readiness Forms from Engineer for each phase of inspection prior to calling for any engineering site inspections. Contractor Readiness Form must be acknowledged in writing and pictures when appropriate, some are room by room, some are per each piece of equipment depending on form. These forms must be completed, signed off by installing contractor as complete and General Contractor as verified, and submitted with request for calling for site inspections. If forms are incomplete, missing name of person verifying, missing phone number of person verifying, then site visit will not be scheduled.

C. **It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense, billed at current Engineer's hourly rates. Minimum return site trip for final inspection due to contractor negligence and not finalizing contractor readiness form $2,500 per trip.**

D. The final acceptance of the work will be made jointly by the Architect and the Owner.

E. Time spent for Investigation/Site Trips due to Contractor lack of installation capabilities/skills or knowledge is not part of Engineer's scope. Therefore, time spent assisting contractor in these matters or problems that arise due to these matters will be billed to Contractor. Engineer will bill the contractor at the current hourly rates of the Engineer. These fees will be paid in full prior to release of contingency.

F. Contractor required to show compliance with code/Owner required commissioning scope. Reference Commissioning requirement for additional scope.

G. Contractor to obtain a Fieldwire Pro license or other software required by Commissioning Agent for the duration of the project.

3.13 DURING FINAL INSPECTION

A. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.

B. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.

3.14 **CLOSE-OUT DOCUMENTS:**

A. Provide PDF of information requested, in organized, bookmarked format.

B. Furnish PDF signed letters of guarantee.

1. Clearly and individually, document all material, equipment and service guarantees beyond a single year.

C. Furnish pdf copy of a statement from the inspecting authority stating that the installation has been accepted and approved.

D. Furnish pdf and an electronic "AutoCad" version, of complete, full-size sets of drawings showing conduit locations by accurate dimensions from permanent structures.

1. "**Record Drawings**" are to include:

a. A sheet legend shall be present on the 1st sheet of the required set which identifies each sheet making-up the set.

b. Site plan(s) with primary and secondary electric power and communication lines to the property line (may be a civil sheet).

c. Site plan(s) with all underground conduits to other buildings, structures, fixtures, and equipment.

d. Marked-up electrical plans and schedules.

E. Furnish pdf complete sets of overload settings and motor data records.

F. Furnish pdf complete sets of the electrical testing results.

G. Furnish pdf complete sets of the power system study final report.

H. Furnish all manufacturer's software if required for start-up or modifying products furnished.

I. Furnish pdf complete sets of the AC Drive's comprehensive manual that includes operation, programming, diagnostics, applications, wiring diagrams, layout diagrams, and outline dimensions.

1. Identify each AC Drive's model number on a cover sheet.

J. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format.

3.15 BIM PROTOCOLS

The following protocols apply to the production, use of, and limits of the electronic model used by, or created by Hendrix Consulting Engineers (HCE) as part of the project Building Information Modeling (BIM) process and specific to the Mechanical, Electrical, Plumbing (MEP) systems or this part of the Project designed by HCE.

The definitions, terms and limits, and descriptions herein shall supersede any contract terms and conditions relating to BIM, or BIM Execution Plan, or similar BIM article(s), when applied to HCE, included as part of the Project.

Purpose of the Model:
The electronic model is an instrument of service, intended for the production of 2-Dimensional (2D) Contract Documents via a 3-Dimensional (3D) design and coordination process. Hendrix Consulting Engineers (HCE) may choose to model those elements determined suitable for 3D coordination. However, the model will not Include all elements necessary for complete MEP systems design and installation nor will it include all elements and requirements reflected on the 2D Contract Documents, which include the Project drawings and specifications.

Expectations for Limits of Modeled Elements:
The model will be used for coordination between design team members as outlined in the Level of Development section below. At the onset of the Project, the design team will agree on the limits of modeled elements.

Generally, modeled elements will include the following:
- HVAC: Pipes greater than 3" (nominal size, not including insulation), ductwork modeled at a design level for general design intent, equipment, and diffusers, registers, grilles, and louvers.
- Plumbing: Piping greater than 3' (nominal size, not including Insulation), equipment, fixtures.
- Electrical: Light fixtures, distribution equipment and panels.

The model will generally **not** Include the following:
- Flanges, fittings, hangers, pull boxes, seismic restraints, and other assembly data subject to the means and methods of construction.
- Thermostats, sensors, detectors, switches, and other wall/ceiling devices denoted by symbol on the plans.
- Dampers and duct accessories with some exceptions at the discretion of HCE.
- Valves and pipe specialties with some exceptions at the discretion of HCE.
- Specific connections to equipment with some exceptions at the discretion of HCE.
- Exterior pipe and duct Insulation and interior ductwork liner will not be modeled.

- Fire Protection systems other than the main piping and components used to develop the performance design.
- Conduit and panels for automated control systems
- Conduit and devices for Fire Alarm systems
- Other “performance design” elements will not be modeled
- Accurate quantities suitable for estimating, construction, or cataloguing.
- Specific manufacturer information other than where HCE, at its sole discretion, chooses to include such information.
- Representation or controlling criteria in regard to the sequencing of construction. Any such information presented by the model is coincidental.
- Fully coordinated systems.

Other stipulations:

- Under no conditions may the model be used for fabrication or quantity take-offs.
- If the model Is forwarded to the Contractor and/or subcontractors, the Contractor and subcontractors may only use the model as a reference-only model to understand design intent.

As noted herein, the model is an instrument of service. As such, any Information contained in the model is subordinate to the printed, 2D Contract Documents. In the case of any conflicts or differences, the 2D Contract Documents are the controlling documents.

Level of Development (LOD):
The following LOD descriptions shall apply to the work performed by, and model provided by, Hendrix Consulting Engineers (HCE). These descriptions include the content requirements and associated authorized uses for each progressively detailed LOD. Each subsequent LOD builds on the previous LOD. The model content requirements apply only to those systems, components, and assemblies HCE chooses to include within the model. The authorized uses noted herein constitute the only allowed uses of the model.

LOD 100
Model Content Requirements. Basic spatial requirements and system concepts used to support the development of the architectural model. Systems and components are not modeled for dimensional or location accuracy.
Authorized Uses. The model may be used to generate 2D drawings representing the design concept. The model may be used by the design team for developing concepts and coordination criteria.
Application. An LOD 100 model will apply to Concept Design and Schematic Design phases.

LOD 200
Model Content Requirements. Model elements are modeled as generalized systems, components, or assemblies with approximate quantities, sizes, shapes, and locations and shall not be considered as ”dimensionally accurate." Non-geometric information may be attached to Model Elements at the sole discretion of HCE. While modeled elements are intended to support the coordination process, modeled elements shall not be considered coordinated at this LOD.
Authorized Uses. The model may be used to generate 2D drawings representing the status of the design. The model may be used by the design team to coordinate rights-of-way for major system components. The model may be used for clash detection by the design team within the limits of expectations defined herein. HCE will not respond to itemized clash reports at this level as modeled elements are not considered coordinated at this level. Clash detection reports will be used as coordination for CD phase documentation only.
Application. An LOD 200 model will apply to the Design Development phase.

LOD 300
Model Content Requirements. Model elements are modeled as generalized systems, components, or assemblies with approximate quantities, sizes, shapes, and locations and shall not be considered as “dimensionally accurate." Non-geometric Information may be attached to Model Elements at the sole discretion of HCE. At this LOD and at the sole discretion of HCE, specific model elements accurate in terms of size and shape may be included. These elements may or may not be imported from specific manufacturers in order to define a basis of design. Where equipment elements are shown, HCE makes no representation of the accuracy of the elements since any manufactured equipment or component is subject to continual change and alternate manufacturers are typically permitted. While modeled elements are intended to support the coordination process at a more detailed level, modeled elements shall not be considered completely coordinated at this LOD.
Authorized Uses. The model may be used to generate 2D drawings representing the status of the design. The model may be used by the design team to coordinate rights-of-way for major system components, primary system components, and secondary distribution components. The model may be used for clash detection by the design team within the limits of expectations defined herein.
Application. An LOD 300 model will apply to the Contract Document phase.

LOD 400:
Model Content Requirements. Model elements are modeled as specific systems, components, or assemblies that are accurate in terms of size, shape, location, and quantity with fabrication, assembly, and detailing information. Non-geometric information may be attached to Model Elements. Where possible, elements are modeled from actual manufacturer’s data to include information specific to the selected manufacturers.
Authorized Uses. The Contractor may choose to produce an LOD 400 model to generate 2D coordination drawings and/or for detailed, 3D installation coordination among the construction team. During this process the design model, which is not an LOD 400 model, may be used by the construction team as a reference-only document to help clarify the design Intent.
Application. An LOD 400 model will apply to the Shop Drawing and Construction Coordination phases and is the responsibility of the Contractor. The Scope of Work for Hendrix Consulting Engineers (HCE) does not include an LOD 400 model.

LOD 500:
Model Content Requirements. Model elements are modeled as actual constructed (As-built) systems, components, and assemblies accurate in terms of size, shape, location, and quantity. Non-geometric Information including Operation and Maintenance Data and linked submittal data is attached to Model Elements where applicable.
Authorized Uses. The model may be used for maintaining, altering, and adding to the Project, but only to the extent consistent with any license granted in other binding Agreements or Contracts or in a separate licensing agreement.

Application. An LOD 500 model will apply to the As-Built phase and is the responsibility of the Contractor. The Scope of Work for HCE does not include an LOD 500 model.

Clash Detection:
It is expected clash detection will be performed by the design team to aid in design coordination. Due to the limits of available software, elements identified as “clashing" may not actually be in conflict and should not be construed as conflicts or errors on the part of the design team. If clash detection will be utilized, an agreement will be made as to what constitutes a “clash' and when resolution of clashes is required. The model is a design tool rather than an installation tool. Therefore, some clashes are expected and may be left in place where a construction resolution is available.

Insomuch as we do not have complete control over the design, selection of materials, or sequencing of construction for the Project, HCE makes no representation that the model will be "clash-free" or without conflicts requiring resolution by the Contractor during the formal production of Shop Drawings and field Coordination Drawings.

Availability of Model.
The model will be made available subject to the Terms of the Prime Agreement.

Contractor's Role:
The Contractor is solely responsible for the decisions made for their use of the model. The Contractor is ultimately responsible for the complete and coordinated installation of all systems depicted on the Contract Documents, whether or not said systems are completely depicted within the model. The model, as an instrument of service, is not intended to dictate means and methods, scheduling requirements, sequencing, or exact quantities; these requirements are the sole responsibility of the Contractor.

Integrated Project Teams:
When integrated project teams, such as Design/Assist, Design/Build, Lean Design, or CM/GC, are part of the project the terms herein shall still apply. However, the project team may alter certain aspects of these terms to allow shared roles in regard to the development of the model. Any such alterations must be approved by HCE and Shall be implemented without additional liability to HCE.

Ownership of Documents:
The model, and all documents produced by Hendrix Consulting Engineers (HCE) under this agreement shall remain the property of HCE and may not be used by the Client for any other endeavor without the written consent of HCE.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

115 East Main Street
COMMISSIONING • FIELD INVESTIGATIONS
Round Rock, Texas 78664

PH: (512) 218-0060
FIRM F-4095
FAX: (512) 218-0077

PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.

B. 2 Submittal CATEGORIES (Reference Specifications)

a. Not required unless deviating from specification

b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures
Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:
Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.

D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

E. **Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.**

F. **Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.**

G. **Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.**

H. **Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."**

I. **Call before submitting a written RFI.**

J. **All formal Job emails must come from Architect.**

K. **Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.**

L. **All equipment that will be controlled by or monitored by the DDC System must include the information needed by the Controls Contractor to properly integrate the equipment with the Controls System.**

M. **All equipment submittals to include a detail instruction on what needs to be set up in the field when the equipment is started up and step-by-step instructions on how to complete the set-up. Do no submit generic information that covers multiple types of equipment. The instructions must be specific to the equipment scheduled with all of the accessories and sequences specified.**

Shop Drawings and Cad Files

A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.

B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.

C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.

D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.

E. Schedule and Details sheets will not be released.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph:

Drawings and Details Affected:

Proposed Substitution/Description:

Installer's Name:

Manufacturer's name:

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____# of pages including cover)

Why is Substitution Being Submitted?

☐Pre-Bid Substitution (Prior Appoval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.
☐Specified product is not available. Explain in detail as attachment.
☐Cost Savings to Owner. Indicate comparative cost analysis as attachment.
☐Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

A. Does substitution affect dimensions shown on drawings? ☐No ☐Yes
B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐No ☐Yes
C. What affect does substitution have on other trades?

_____

D. Differences between proposed substitution and specified item?

_____

E. Indicate how proposed substitution meets LEED requirements. (if applicable)
F. Manufacturer's guarantees of proposed and specified items are:
☐Same ☐Different (explain on attachment)

The Contractor and Subcontractor certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respectes to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Similar maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

_____

_____

_____

_____

_____

For A/E Use: SR# _____

☐Accepted ☐Accepted as Noted
☐Not Accepted ☐Received Too Late
☐Incomplete Information
☐No Substitutions Accepted
Reviewed by/date: _____
Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:
☐FILE ☐OWNER ☐CONTRACTOR
☐ENGINEER ☐_____

MEP/ENERGY CONSULTANTS
HENDRIX CONSULTING ENGINEERS
COMMISSIONING • FIELD INVESTIGATIONS

115 E. Main Street
Round Rock, Texas 78664
(512)218-0060-office
(512)218-0077-fax

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

MECH / ELEC EQUIPMENT COORDINATION SHEET

(THIS IS REQUIRED – NOT OPTIONAL)

ELECTRICAL CONTRACTOR TO REVIEW AND SIGN (EACH PAGE) PRIOR TO MECHANICAL EQUIPMENT SUBMITTAL OR ELECTRICAL GEAR SUBMITTAL.

ELECTRICAL CONTRACTOR:_____

MECHANICAL CONTRACTOR:_____

MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE	MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

PLBG / ELEC EQUIPMENT COORDINATION SHEET

(THIS IS REQUIRED – NOT OPTIONAL)

ELECTRICAL CONTRACTOR TO REVIEW AND SIGN (EACH PAGE) PRIOR TO PLUMBING EQUIPMENT SUBMITTAL OR ELECTRICAL GEAR SUBMITTAL.

ELECTRICAL CONTRACTOR:_____

PLUMBING CONTRACTOR:_____

MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE	MARK #	UNIT TYPE	MOCP	VOLTAGE	PHASE

END OF SECTION

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Pre - Wall Cover-Up
Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE COMMON ITEMS NOTED FOR THIS INSPECTION AND MUST BE CHECKED IN EVERY ROOM PRIOR TO REQUESTING AN ABOVE CEILING INSPECTION FOR THAT ROOM.

GENERAL ITEMS:

Completed ( ) / Initials

❑/_____ITEM NO.1: WHERE EXTERNAL INSULATION TERMINATES, SEAL INSULATION TO DUCTWORK WITH MASTIC AND 3" GLASS FIBER REINFORCING MESH PER SPECIFICATION SECTION '20 07 00, 3.04, C.'.

❑/_____ITEM NO.2: FOR ALL ROOF MOUNTED MECHANICAL EQUIPMENT, ONLY CUT ROOF DECK FOR DUCT DROPS. SPECIFICATION SECTION

❑/_____ITEM NO.3: WHEN REFRIGERANT PIPING IS LOCATED BEHIND WALLS, INSURE REFRIGERANT PIPING DOES NOT COME IN CONTACT WITH STEEL STUDS OR CLAMPS, AND HAS NAIL/SCREW PROTECTION AT STUDS. SPECIFICATION SECTION

❑/_____ITEM NO.4: RAINLEADER PIPE SIZE MAY NOT BE REDUCED IN DIRECTION OF DISCHARGE, MUST REMAIN FULL SIZE INCLUDEDING DROPS. RAINLEADER PIPING, RAINLEADER BODY AND FLANGES MUST BE INSULATED PERS SPECIFICATION

❑/_____ITEM NO.5: HORIZONTAL MC CABLE IS NOT ALLOWED IN WALL CAVITY. SPECIFICATION SECTION

❑/_____ITEM NO.6: FOR ALL DEVICE ROUGH-IN NEAR DOOR, FOLLOW DETAIL ON ELECTRICAL SHEETS. USE CADY BRACKETS TO GET MULTPLE DEVICES IN SINGLE STUD SPACE. ALL SWITCHES, THERMOSTATS, INTERCOM BUTTONS, WALL FIRE ALARM DEVICES INSTALLED BY DOOR PER ROUGH-IN DETAILDEVICES SHOULD NOT EXTEND OVER 24" FROM DOOR FRAME. NO DEVICES SHOULD BE ROUGHED-IN, THAT WOULD CONFLICT WITH CABINETS OR WHITE BOARDS. ITEMS DEVIATING FROM DETAIL THAT CAUSE OWNER PROBLEMS WILL BE RELOCATED EVEN AFTER SHEETROCK INSTALLED. SPECIFICATION SECTION

❑/_____ITEM NO.7: ALL EXPOSED EXTERIOR CONDUIT FROM GRADE TO PANEL OR 36" AND BELOW, MUST BE RIGID PIPE. CONDUIT NOT FOLLOWING SPECIFICATION WILL HAVE TO BE REMOVED

AND REPLACED, EVEN IF WIRE HAS ALREADY BEEN PULLED. PAY SPECIAL ATTENTION TO EXTERIOR RACK MOUNTED SERVICES. SPECIFICATION SECTION

❑/_____ITEM NO.8: ALL CONDUIT AND J-BOX STRAPS AND SPACING MUST BE PER CODE.

❑/_____ITEM NO.9: TECHNOLOGY AND POWER TO BE WITHIN 6" OF EACH OTHER OR IN SAME STUD SPACE WHEN SHOWN TOGETHER. REFERENCE POWER AND TECHNOLOGY PLANS. REFERENCE BLOCK NOTE ON POWER PLANS. DEVICES INTENDED TO BE LOCATED NEXT TO EACH OTHER THAT ARE NOT IN THE SAME STUD SPACE WILL BE RELOCATED, EVEN AFTER SHEETROCK. SPECIFICATION SECTION

❑/_____ITEM NO.10: CONFIRM TRANSFER DUCTS INSTALLED IN ALL WALLS TO DECK WHEN SHOWN ON PLANS OR REQUIRED FOR RETURN AIR PATH. PROVIDE PLAN HIGHLIGHTING ALL WALLS TO DECK AND INSTALLED TRANSFERS. SPECIFICATION SECTION

❑/_____ITEM NO.11: WHEN CONDUIT PENETRATES FLOOR, HOLES IN SUSPENDED SLABS, HOLES MUST BE SEALED FROM TOP AND BOTTOM PRIOR TO CLOSING UP WALLS. SPECIFICATION SECTION

❑/_____ITEM NO.12: PROVIDE DRAWING SHOWING LOCATION AND SIZE OF ALL WATER HAMMER ARESSTORS INSTALLED. MUST BE INSTALLED AND SIZED PER SPECIFICAITON AND MANUFACTURES INSTALLATION INSTRUCTION. SPECIFICATION SECTION

❑/_____ITEM NO.13: ENSURE GROUNDING/BONDING BUSHINGS ON ALL PANEL CONDUITS AND GROUNDING CONDUITS FROM TRANFORMERS. SPECIFICATION SECTION

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Pre - Above Ceiling
Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE COMMON ITEMS NOTED FOR THIS INSPECTION AND MUST BE CHECKED IN EVERY ROOM PRIOR TO REQUESTING AN ABOVE CEILING INSPECTION FOR THAT ROOM.

GENERAL ITEMS:

Completed ( ) / Initials

❑/_____ITEM NO.1: CONFIRM ALL RUN OUT TAPS HAVE BALANCING DAMPERS WITH STAND-OFF MOUNTING BRACKETS PER SPECIFICAN AND DETAILS. SPECIFICATION SECTION

❑/_____ITEM NO.2: CONFIRM ALL EXHAUST DUCT WITHIN 36” OF ROOF DECK OR EXTERIOR WALL IS INSULATED PER PLANS AND SPECIFICATIONS. SPECIFICATION SECTION

❑/_____ITEM NO.3: CONFIRM RETURN AIR PATH BACK TO ALL UNITS IS NOT BLOCKED BY WALLS TO DECK. CONFIRM ALL TRANSFERS HAVE BEEN INSTALLED. PROVIDE PLAN HIGHLIGHTING WALLS TO DECK AS INSTALLED AND HIGHLIGHTING AIR TRANSFERS INSTALLED FOR REVIEW. THIS IS FOR REVIEW TO CONFIRM IF ANY ADDITIONAL TRANSFERS ARE REQUIRED OR OPENING ABOVE CEILING NEED TO BE CUT INTO SHEET ROCK ON WALLS TO DECK PRIOR TO CEILING COVER UP. SPECIFICATION SECTION

❑/_____ITEM NO.4: REFRIDGERANT PIPING: CONFIRM ALL REFRIGERANT PIPING IS COMPLETELY INSULATED AND INSULATION SEALED, INCLUDING CONTINIOUSLY THROUGH WALLS. ENSURE PIPE SADDLES ARE INSTALLED AT ALL SUPPORTS FOR REFRIGERANT PIPING. SPACING PER SPECIFICATIONS

❑/_____ITEM NO.5: CONFIRM BACK OF ALL SUPPLY GRILLES ARE INSULATED. SPECIFICATION SECTION

❑/_____ITEM NO.6: ALL EXTERIOR LIGHTS SEALED TO BUILDING.

❑/_____ITEM NO.7: CONFIRM ANY DAMAGED INSULATION FOR DUCTWORK, WATER PIPING, REFRIGERANT PIPING IS REPAIRED AND PROPERLY SEALED TO PREVENT CONDENSATION.

SPECIFICATION SECTION

❑/_____ITEM NO.8: CONFIRM ALL PENITRATIONS THROUGH FIRE WALLS HAVE BE CAULKED. SPECIFICATION SECTION

❑/_____ITEM NO.9: CONFIRM ACCESS DOORS ARE PROVIDED FOR ALL FIRE/SMOKE DAMPERS AND OTHER REQUIRED LOCATIONS, PER DETAILS, SPECIFICATIONS FOR ACCESS TO REQUIRED COMPONENTS. ENSURE ACCESS DOORS ARE PROVIDED IN DUCTWORK AS DECRIBED IN RTU AND AHU DETAILS AT FIRST 90° TURN FOR RTU AND BOTH SUPPLY AND RETURN OF AHU. REFERENCE SPECIFICATION FOR PROPER SIZE AND SPACING.

❑/_____ITEM NO.10: CONFIRM ALL MECHANICAL UNITS, WATER HEATERS, PANELBOARDS, TRANSFORMERS ETC.. ARE LABELED WITH ALL REQUIRED INFORMATION AND WITH PROPER MATERIAL PER SPECIFICATION ’20 01 00, 3.05, B’.

❑/_____ITEM NO.11: CONFIRM ALL CABLES ARRE INDEPENDANTLY SUPPORTED PER SPECIFICAITON. CONTROLS, FIRE ALARM, LIGHTING CONTROL, POWER, TECHNOLOGY, INTERCOM ETC.. SPECIFICATION SECTION

❑/_____ITEM NO.12: CONFIRM INSULATION IS SEALED AT ALL HANGERS. SPECIFICATION SECTION

❑/_____ITEM NO.13: CONFIRM ISOLATORS ARE INSTALLED AT ALL EQUIPMENT AS REQUIRED BY SPECIFICATION AND DETAILS. SPECIFICATION SECTION

❑/_____ITEM NO.14: FOR ALL EXTERIOR EQUIPMENT: CONFIRM HAIL GUARDS ARE INSTALLED IMEDIATELY WHEN UNIT IS INSTALLED AT SITE TO PREVENT HAIL DAMAGE FROM OCCURING. HAIL DAMAGE DURING CONSTRUCTION DUE TO NOT INSTALLING HAIL GUARDS IS CONTRACTORS RESPONSIBILITY. SPECIFICATION SECTION

❑/_____ITEM NO.15: ROOF MOUNTED CONDENSING UNITS: CONFIRM ALL ROOF MOUNTED CONDENSING UNIT ARE INSTALLED ON THY-CURBS, ALL METAL CROSS SUPPORTS ARE GALVANIZED AND CUT ENDS ARE PAINTED WITH GALVANIZED PAINT. ALL CONDENSING UNITS MUST BE PROPERLY SECURED TO THY-CURB PER DETAIL. NO PENITRATIONS ALLOWED IN TOP OF THY CURB. INSURE ALL SIDE DISCHARGE CONDENSING UNIT ARE AIMED CORRECTLY AND NOT BLOWING INTO INTAKE OF ADJACENT CONDENSING UNIT. INSURE ALL SIDE DISCHARGE CONDENSING UNIT HAVE AIR DIRVERTER INSTALLED CORRECTLY IN THE UP POSITION. SPECIFICATION SECTION

❑/_____ITEM NO.17: EXTERIOR REFRIGERATION PIPING: INSURE ALL EXTERIOR REFRIGERANT PIPING INSULATION IS WEATHER PROOFED

WITH ALUMINUM WRAP PER SPECIFICATIONS.
SUPPORTED PROPERLY AND INSTALLED IN MANNER THAT DOES NOT IMPEAD MAINTANANCE ACCESS.
SPECIFICATION SECTION

❑/_____ITEM NO.19: INSULATION THROUGH WALLS: VERIFY ALL DUCTWORK, PIPING, AND REFIGERATION PIPING INSULATION IS CONTINUOUS THROUGH WALLS. BREAKS IN INSULATION INSIDE WALL WILL CAUSE CONDENSATION AND MOLD SPECIFICATION SECTION

❑/_____ITEM NO.21: PIPING LABELING: CONFIRM ALL PIPING IS LABELED WITH WATER TYPE AND DIRECTIONAL ARROWS, WITH PROPER COLOR, SIZE, SPACING PER SPECIFICATION SECTION '20 01 00, 3.09, C'.

❑/_____ITEM NO.22: CONFIRM ALL VALVES ARE TAGGED PER SPECIFICATION SECTION '20 01 00, 3.05, A'. PROVIDE MAP OF ALL LOCATION IN PDF FORM TO OWNER.

❑/_____ITEM NO.23: PROVIDE CEILING ACCESS MARKERS FOR ALL MECHANICAL UNITS, VALVES, ETC… PER SPECIFICATION SECTION '20 01 00, 3.05, D'.

❑/_____ ITEM NO.25: INSURE ALL REFRIDGERANT PIPING, WATER PIPING AND DUCTWORK SUPPORTS ARE PROVIDED PIPE SADDLES UNDER HANGERS AS REQUIRED FOR ALL LOCATIONS. SUPPORT SPACING MUST BE PER SPECIFICAITONS

❑/_____ ITEM NO.26: EXTERIOR MEP PENITRATIONS: ALL PENITRATION THROUGH EXTERIOR WALLS/DRAINPLANES MUST BE SEALED WATER TIGHT PER DETAILS AND SPECIFICATIONS. INCLUDING BUT NOT LIMITED TOO: RAINLEADER, CONDUIT, HOSE BIBBS, REFRIGERANT PIPING, FIRE SPRINKLER TEST PIPE, LIGHT FIXTURES, RECEPTACLES, WATER PIPING PENETRATIONS ETC… SPECIFICATION SECTION

❑/_____ ITEM NO.28: PIPING SUPPORTS: INSURE PROPER PIPING SUPPORTS ARE USED TO SUPPORT DISIMALER METALS PER SPECIFICATION SECTION

❑/_____ ITEM NO.29: GAS PIPING ON ROOF: ALL BRANCH GAS TAP MUST BE TAPPED OFF TOP OF MAIN GAS LINE. DIRT LEG MUST BE INSTALLED AT ALL UNIT CONNECTIONS MINIMUM 3" ABOVE ROOF. ALL GAS PIPING MUST BE PRIMED AND PAINTED. MUST BE SPORTED WITH PPI TYPE ROLLER SUPPORTS WITH PROPER SPACING PER SPECIFICATION SECTION

❑/_____ ITEM NO.30: PEX PIPING SUPPORTS(WHEN USED): INSURE CORRECT PEX ISOLATION FITTINGS ARE BEING USED TO SUPPORT PEX PIPING IN WALL. CONFIRM CORRECT CONTINIOUS PEX SADDLE SUPPORT IS BEING USED FOR PEX ABOVE CEILING, TO MAINTAIN FLAME SMOKE RATING.

SPECIFICATION SECTION

❑/_____ ITEM NO.33: LABEL ALL J-BOXES WITH CIRCUIT AND PANEL NUMBERS. SPECIFICATION SECTION

❑/_____ ITEM NO.34: CONFIRM ALL TRANSFORMER GROUND CONNECTIONS HAVE BEEN INSTALLED. SPECIFICATION SECTION

❑/_____ ITEM NO.35: CONFIRM ALL UNUSED OPENINGS IN JUNCTION BOXES ARE PROPERLY SEALED. SPECIFICATION SECTION

❑/_____ ITEM NO.36: CONFIRM REMOVAL OF ALL TEMPORARY AND UNUSED WIRING AND LIGHTING WHEN APPROPRIATE. SPECIFICATION SECTION

❑/_____ ITEM NO.37: CONFIRM LABELING AND PAINTED RED ALL FIRE ALARM JUNCTION BOXES. SPECIFICATION SECTION

❑/_____ ITEM NO.38: CONFIRM ALL J-BOXES ABOVE CEILINGS ARE ACCESSIBLE. SPECIFICATION SECTION

❑/_____ ITEM NO.39: CONFIRM ALL FLEX CONDUIT ABOVE CEILING IS INDEPENDENTLY STRAPPED. SPECIFICATION SECTION

❑/_____ ITEM NO.40: CONFIRM DUCT DETECTORS ARE INSTALLED WHERE REQUIRED. REFERENCE UNIT SCHEDULE, FIRE ALARM SHOP DRAWINGS AND UNITS OVER 2000 CFM. REFERENCE SPECIFICAITON

❑/_____ ITEM NO.41: CONFIRM ALL CEILING MOUNTED EXIT SIGNS ARE SECURED TO STRUCTURE. SPECIFICATION SECTION

❑/_____ ITEM NO.42: CONFIRM ALL LIGHT FIXTURES HAVE INDEPENDENT SUPPORTS ON MINIMUM 2 CORNERS AND CONFIRM THEY ARE SECURED TO STRUCTURE. SPECIFICITON SECTION

❑/_____ ITEM NO.44: ROOF MOUNTED TRANSFORMERS AND PANELS: INSTALL ON THY-CURBS PER DETAIL. ALL STEEL CROSS SUPPORT TO BE HOT DIP GALVANIZED, CUT ENDS PAINED WITH GALVANIZING PAINT. PROVIDE FOOTPLATE AND RUBBER ISOLATER PAD UNDER FEET OF TRANSFORMER. PROPERLY SECURE TRANSFORMER AND PANEL TO SUPPORT, DO NOT PENITRATE TOP OF THY CURB. DO NOT LEAVE METAL SHAVINGS CAUSING RUST WHEN CUTS ARE MADE. SPECIFICATION SECTION

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Pre - Final Punch Inspection
Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE REQUIRED TO BE ADDRESSED AND SIGNED OFF IN WRITING BY CONTRACTOR FOR EACH UNIT OR ROOM AS INDICATED BY INDIVIDUAL ITEMS BELOW. THESE ITEMS MUST BE COMPLETED AND SUBMITTED WITH ANY DEFICIENCIES CORRECT PRIOR TO REQUESTING FINAL MEP INSPECTION.

GENERAL ITEMS:

COMPLETED ( ) / INITIALS

❑/_____ITEM NO.1: ALL MECHANICAL UNITS: PROVIDE CONTRACTOR READINESS CHECKLIST (START-UP FORMS),

- MECHANICAL CONTRACTOR - START-UP REPORTS
- MANUFACTURER START-UP FORM (WHEN REQUIRED)
- MECHANICAL START-UP FORM
- CONTROLS START-UP FORM
- TEST-BALANCE WITH ALL DEFICIENCIES ADDRESSED.
- COMMISSIONING FOR ALL MECHANICAL UNITS AS LISTED IN SPECIFICATION. SCHEDULE OF VALUE LINE ITEM WILL NOT BE PAID UNTIL ALL FORMS FOR ALL EQUIPMENT HAVE BEEN COMPLETED, SUBMITTED AND REVIEWED. PARTIAL PAYMENT WILL NOT BE PROVIDED. SPECIFICATION SECTION 20 00 00.

❑/_____ITEM NO.2: PROVIDE TEST AND BALANCE REPORT WITH ALL DEFICIENCIES ADDRESSED AND WITH DISCHARGE AIR TEMPS IN COOLING MODE PER SPECIFICATIONS.

❑/_____ITEM NO.3: CONFIRM ALL THERMOSTATS CALIBRATED AND ADJUSTED TO + OR – 1 DEGREE ACCURACY. PROVIDE SIGNED FORM FOR ALL SENSORS.

❑/_____ITEM NO.4: CONFIRM LABELING ALL THERMOSTATS PER SPECIFICATION SECTION ’20 01 00, 3.05, C.’.

❑/_____ITEM NO.5: DUCTWORK AND INSIDE OF MECHANICAL UNITS TO BE CLEANED.

❑/_____ITEM NO.6: CLEAN SET OF FILTERS TO BE INSTALLED IN ALL UNITS.

❑/_____ITEM NO.7: CHECK DISCHARGE AIR TEMPERATURE OFF OF ALL COOLING UNITS. (INCLUDE DISCHARGE AIR IN COOLING FOR EACH STAGE OF COOLING, MUST BE 56 DEGREES OR COOLER, REFERENCE START-UP FORMS)

❑/_____ITEM NO.8: CHECK DISCHARGE AIR TEMPERATURE AND HUMIDITY OFF OF ALL MAKEUP/OUTSIDE AIR UNITS. (MUST BE 53 DEGREES OR COOLER OFF COIL)

❑/_____ITEM NO.9: PROVIDE LABEL AND DIRECTIONAL ARROWS ON BOTH SIDES OF LABELS ON ALL PIPING PER SPECIFICATION SECTION ’20 01 00, 3.09, C.’, INCLUDING ABOVE CEILING AND WATER HEATER ROOMS.

❑/_____ITEM NO.10: TAG ALL VALVES PER SPECIFICATION SECTION ’20 01 00, 3.05, A.’.

❑/_____ITEM NO.11: PROVIDE CEILING ACCESS MARKERS PER SPECIFICATION SECTION ’20 01 00, 3.05, D.’.

❑/_____ITEM NO.12: LABEL ALL EQUIPMENT PER SPECIFICATION SECTION ’20 01 00, 3.05, B.’.

❑/_____ITEM NO.13: SINKS:

- CONFIRM ALL EXPOSED SINK WASTE PIPE HAS ‘ADA’ PADDING INSTALLED.
- CONFIRM TMV LOCATED AT EACH SINK REQUIRED ON PLUMBING FIXTURE SCHEDULE.
- PROVIDE AS BUILT OF WATER HAMMER ARRESTORS SIZE AND LOCATION.

❑/_____ITEM NO.14: LABEL PANELBOARDS PER SPECIFICATION SECTION ‘26 05 00, 3.09, K. INCLUDE ALL INFORMATION REQUIRED, AND TYPED PANELBOARD SCHEDULES WITH ROOM NAMES.

❑/_____ITEM NO.15: PROVIDE FACTORY START-UP AND PROGRAMMING OF ‘NLIGHT’ LIGHTING CONTROLS. PROVIDE DOCUMENTATION THAT THIS FACTORY PROGRAMMING HAS OCCURRED.

❑/_____ITEM NO.16: PROVIDE DOCUMENTATION THAT MANUFACTURER ONSITE TESTING HAS BEEN COMPLETED FOR SURGE PROTECTION.

❑/_____ITEM NO.17: PROVIDE DOCUMENTATION FOR TRANSFORMERS THAT MANUFACTURER HAS VERIFIED CONNECTIONS AND TESTED USB PORT FUNCTION.

❑/_____ITEM NO.18: CLEAN ALL CONSTRUCTION DEBRIS FROM INSIDE UNITS AND ON ROOF.

❑/_____ITEM NO.19: VERIFY THAT MECHANICAL CONTROL SYSTEM IS COMPLETE.

- ENSURE THAT ACCESS TO CONTROLS IS CONNECTED AND OPERATIONAL.
- OWNER SCHEDULE HAS BEEN INPUT.
- ALL SEQUENCES OF OPERATION FUNCTION PROPERLY
- ALL CONTROL START-UP FORMS COMPLETED AND SUBMITTED.
- ENGINEER WILL REQUIRE ACCESS TO CONTROL SYSTEM DURING FINAL VISIT. PROVIDE ACCESS CODES AND PASSWORDS TO ENGINEER.

❑/_____ITEM NO.20: ALL MECHANICAL, ELECTRICAL AND PLUMBING EQUIPMENT MUST BE POWERED UP AND OPERATIONAL.

❑/_____ITEM NO.21: PAINT AND PRIME ALL GAS PIPING PER SPECIFICATIONS.

❑/_____ITEM NO.22: ROOF SUPPORTS:

- PROVIDE CARRY TREAD / WALK PAD UNDER ALL ROOF SUPPORTS (GAS PIPING, CONDENSATE DRAINS, ETC.) REFERENCE ROOFING SPECIFICATION FOR ALL REQUIREMENTS.
- SUPPORTS PROVIDED PER SPACING REQUIREMENTS IN SPECIFICATIONS.

❑/_____ITEM NO.23: VERIFY INSTALL AND TEST DRAIN PAN FLOAT SWITCH.

❑/_____ITEM NO.24: DUCT ACCESS DOORS: CONFIRM ACCESS DOORS ARE PROVIDED FOR ALL FIRE/SMOKE DAMPERS AND OTHER REQUIRED LOCATIONS, PER DETAILS, SPECIFICATIONS FOR ACCESS TO REQUIRED COMPONENTS. ENSURE ACCESS DOORS ARE PROVIDED IN DUCTWORK AS DECRIBED IN RTU AND AHU DETAILS AT FIRST 90° TURN FOR RTU AND BOTH SUPPLY AND RETURN OF AHU. REFERENCE SPECIFICATION FOR PROPER

SIZE AND SPACING.

❑/_____ITEM NO.25: ALL WEATHERPROOF RECEPTACLE COVERS ARE REQUIRED TO BE METAL PER SPECIFICATION. PLASTIC NOT ALLOWED.

❑/_____ITEM NO.26: WATER HEATER INSTALLATION CONTRACTOR READINESS CHECKLIST.

❑/_____ITEM NO.27: ELECTRICAL CERTIFICATE OF COMPLETION PER SPECIFICATIONS, INCLUDING ALL GROUNDING TESTING, MEGGER READINGS REQUIRED BY SPECIFICATIONS.

❑/_____ITEM NO.28: DO NOT CALL FOR FINAL INSPECTION UNTIL ALL UNITS HAVE HAD MECHANICAL START-UP FORMS, TEST AND BALANCE, AND CONTROLS FULLY INTEGRATED AND SUBMITTED TO ENGINEER AND COMMISSIONING AGENT.

❑/_____ITEM NO.29: CONTRACTOR READINESS FORMS COMPLETE FOR EACH PIECE OF EQUIPMENT: (ATTACHED)

A. MECHANICAL UNITS – AHU, RTU, MAU
B. WATER HEATERS

Sign before requesting Final Inspection:
Signature of Person Completing Readiness Checklist. _____Date_____

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

115 East Main Street Round Rock, Texas 78664

COMMISSIONING • FIELD INVESTIGATIONS

PH: (512) 218-0060 FAX: (512) 218-0077

ROOF TOP UNITS (RTU)
Contractor Readiness Checklist

Roof Top Unit (RTU)

The installing contractor must check and verify all items listed below, prior to calling for a Final RTU inspection. This check list must be completed for all Roof Top Units as part of Final Inspection Readiness. The person performing the check must provide a signed form for each unit. Provide complete signed and dated for each unit prior to calling for final inspection.

- Unit installation:
  - The manufacturer's service and operating clearances have been provided and if free of conduit, piping, ductwork, etc.
  - Unit is level.
  - Hail Guards installed.
  - Unit Curb and Flashing per job details.
  - Roof deck only cut for duct drops, not entire curb dimension.
  - 2 layers of exterior sheathing installed on roof deck inside of curb for sound attenuation.
  - Permanent Label Installed
  - Door Handles installed.
- Drain pan :
  - The float switch is installed, wired to controls and has been tested.
  - Pan has been cleaned of all construction debris.
- Condensate drain:
  - Material is copper.
  - Installed per details with proper trap depth.
  - All cleanouts are installed for easy maintenance.
  - Unions installed per detail
  - Installed with the proper amount of slope.
  - Terminates at a code approved disposal point.
  - The insulation installed and sealed per detail and specification and does not have gaps.
  - Ensure proper air gap at all condensate disposal points.
- Ductwork Items:
  - Ductwork has been connected to the RTU unit as shown in detail.
  - Ductwork insulation ends have been sealed in return air of the RTU.
  - Internal duct insulation 48" past first 90 bend per detail. (unless owner request external)
  - RA internally lined per detail with sheet metal duct liner stops(unless owner request external)
  - Duct Wrap insulation has been terminated as detailed.
  - Duct insulation is continuous under duct smoke detectors.

        - Duct access door on supply air after first 90 per detail.
        - Duct access doors on both sides of turning vanes when installed.
        - The access door in the return air plenum is installed in an easily accessible location for inspection and cleaning. (Access door not required if duct is open for plenum return)
        - If an outside air duct is to be connected to Return Air Duct, it must be downstream from the return air inlet / connection.
        - The first supply branch duct tap must be downstream from the duct/smoke detector.
        - Duct taps no allowed within 48" past elbow.
    - Unit access:
        - Ensure Filter removal access is not blocked.
        - Verify that all access doors can be opened or removed without damaging the insulation vapor barrier, per details, specifications, for all required components including Fire/Smoke dampers.
        - No ductwork, Electrical conduit, Fire Alarm Cable, or Controls Wiring to be located in service access area.
        - Disconnect not installed blocking access door.
        - Maintenance Receptacle operational.
    - Gas
        -
    - Follow ALL associated details
        - Rooftop Unit Curb/Flashing Detail
        - Deep Seal Trap Detail
        - Duct Drop Detail
        - Typical Gas/Condensate Piping Connection Detail

Signature of Person Completing Readiness Checklist. _____Date_____

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street **Round Rock, Texas 78664**

PH: (512) 218-0060 **FAX: (512) 218-0077**

AIR HANDLING UNIT (AHU)
Contractor Readiness Checklist

Air Handling Unit (AHU)

The installing contractor must check and verify all items listed below, prior to calling for a Final AHU inspection. This check list must be completed for all Air Handling Units as part of Final Inspection Readiness. The person performing the check must provide a signed form for each unit. Provide complete signed and dated for each unit prior to calling for final inspection.

- Unit installation:
  - The manufacturer's service and operating clearances have been provided and if free of conduit, piping, ductwork, etc.
  - Spring isolators have been properly sized and installed per the manufacturer's installation instructions. Specifically, all nuts must be field adjusted for proper travel.
  - The refrigerant piping has been installed in a neat workman like manner and does not interfere with required service and operating clearances.
  - Refrigerant piping supported per refrigerant piping detail.
  - Verify unit is installed with positive slope toward condensate drain.
  - Unistrut supporting unit to be installed per detail (long direction of unit)
  - 2" filter rack installed.
- Condensate drain:
  - Installed per details with proper trap depth.
  - All cleanouts are installed for easy maintenance.
  - Installed with the proper amount of slope.
  - Terminates at a code approved disposal point.
  - The insulation is sealed per specification and does not have gaps.
  - Ensure proper air gap at all condensate disposal points.
- Auxiliary Drain pan :
  - Extends beyond air-handling unit as shown / noted in detail.
  - Has the supports installed inside and underneath the pan as shown in detail. (Long direction of pan)
  - The float switch is installed, wired to controls and has been tested.
  - A drain has been installed in Aux Drain Pan and is capped or piped off to the exterior of the building as shown or note on the drawings.
  - Pan has been cleaned of all construction debris.
  - Neoprene isolation tape has been installed between the pan and supports and between the supports and unit as shown in detail.
- Ductwork Items:
  - Ductwork has been connected to the Air Handling unit as shown in detail.

        - Ductwork has been sealed at the Air Handling unit as shown in detail.
        - Duct Wrap insulation has been terminated at the Air Handling unit as detailed.
        - Duct insulation is continuous under duct smoke detectors.
        - The access door in the return air plenum is installed in an easily accessible location for inspection and cleaning. (Access door not required if duct is open for plenum return)
        - If an outside air duct is to be connected to Return Air Duct, it must be downstream from the return air inlet / connection.
        - The first supply branch duct tap must be downstream from the duct/smoke detector.
    - Unit access:
        - Verify that all access doors can be opened or removed without damaging the insulation vapor barrier, per details, specifications, for all required components including Fire/Smoke dampers.
        - Supports do not interfere with the removal of the access doors.
        - Ensure Filter removal access is not blocked.
        - Verify that all access doors can be opened or removed without damaging the insulation vapor barrier.
        - No ductwork, Electrical conduit, Fire Alarm Cable, or Controls Wiring to be located in service access area.
    - Unit Test and Balance completed and ALL deficiencies resolved and provided to Engineer.
    - Equipment Start-up form Completed and provided to Engineer.
    - Controls Integrated and verified operational.
    - Unit Discharges 58 degrees or cooling in ALL speed of cooling, and recorded.

Signature of Person Completing Readiness Checklist. _____Date_____

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street **Round Rock, Texas 78664**

PH: (512) 218-0060 **FAX: (512) 218-0077**

WATER HEATER (WH)
Contractor Readiness Checklist

Water Heater (WH)

The installing contractor must check and verify all items listed below, prior to calling for a Final WH inspection. This check list must be completed for all water heating units as part of Final Inspection Readiness. The person performing the check must provide a signed form for each unit. Provide complete signed and dated for each unit prior to calling for final inspection.

- Unit installation: (per details on plans)
  - The manufacturer's service and operating clearances have been provided and if free of conduit, piping, ductwork, etc.
  - WH has T&P piped off per code.
  - Unions installed on hot and cold water connections above WH for future maintenance.
  - Drain pan installed,
  - WH sits on Unistrut to lift up in drain pan.
  - Drain pan drain line installed.
  - Expansion tank installed, wall mounted or suspended. (not on floor)
  - Check valve, balancing valves, ball valves, and strainers all installed per detail.
  - HW, CW, HWR all piped according to detail.
  - Aquastat installed.
  - Vacuum breaker installed.
  - Housekeeping pad installed when required.
  - Perforated straps are not allowed for supporting of piping or equipment.
- Piping:
  - Insulated with PVC jacketing per specifications.
  - Ends of insulation covered with mastic.
  - The insulation is sealed per specification and does not have gaps.
  - All piping labeled, with correct label spacing.
  - All piping to be installed in a manner to make changeout of WH easy.
  - Valve Tags installed
- Gas WH:
  - Gas pipe with sufficient straight piece to allow water heater or boiler to function properly.
  - Dirt leg installed with cap and not touching ground.
  - Combustion Air vent piping installed per manufacturer installation instructions.
    - For intake length including bends
    - For exhaust length including bends
    - Termination location, including distance from obstructions and parapets.
  - Provide Acid Neutralization Trap for all condensing gas water heaters.

Signature of Person Completing Readiness Checklist. _____Date_____

MEP/ENERGY CONSULTANTS

HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

PH: (512) 218-0060 FAX: (512) 218-0077

Outstanding Items Final Punch Inspection Contractor Readiness Checklist

THE FOLLOWING ITEMS ARE REQUIRED TO BE ADDRESSED AND SIGNED OFF IN WRITING BY CONTRACTOR FOR EACH UNIT OR ROOM AS INDICATED BY INDIVIDUAL ITEMS BELOW. THESE ITEMS MUST BE COMPLETED AND SUBMITTED WITH ANY DEFICIENCIES CORRECT PRIOR TO REQUESTING FINAL MEP INSPECTION.

GENERAL ITEMS:

COMPLETED ( ) / INITIALS

❑/_____ITEM NO.1: ALL MECHANICAL UNITS: PROVIDE CONTRACTOR READINESS CHECKLIST (START-UP FORMS),

- MECHANICAL CONTRACTOR - START-UP REPORTS
- MANUFACTURER START-UP FORM (WHEN REQUIRED)
- MECHANICAL START-UP FORM
- CONTROLS START-UP FORM
- TEST-BALANCE WITH ALL DEFICIENCIES ADDRESSED.
- COMMISSIONING FOR ALL MECHANICAL UNITS AS LISTED IN SPECIFICATION. SCHEDULE OF VALUE LINE ITEM WILL NOT BE PAID UNTIL ALL FORMS FOR ALL EQUIPMENT HAVE BEEN COMPLETED, SUBMITTED AND REVIEWED. PARTIAL PAYMENT WILL NOT BE PROVIDED. SPECIFICATION SECTION 20 00 00.

❑/_____ITEM NO.2: PROVIDE TEST AND BALANCE REPORT WITH ALL DEFICIENCIES ADDRESSED AND WITH DISCHARGE AIR TEMPS IN COOLING MODE PER SPECIFICATIONS.

❑/_____ITEM NO.3: CONFIRM ACCESS DOORS ARE PROVIDED FOR ALL FIRE/SMOKE DAMPERS AND OTHER REQUIRED LOCATIONS, PER DETAILS, SPECIFICATIONS FOR ACCESS TO REQUIRED COMPONENTS. ENSURE ACCESS DOORS ARE PROVIDED IN DUCTWORK AS DECRIBED IN RTU AND AHU DETAILS AT FIRST 90° TURN FOR RTU AND BOTH SUPPLY AND RETURN OF AHU. REFERENCE SPECIFICATION FOR PROPER SIZE AND SPACING.

❑/_____ITEM NO.4: CONFIRM ALL THERMOSTATS CALIBRATED AND ADJUSTED TO + OR – 1 DEGREE ACCURACY. PROVIDE SIGNED FORM FOR ALL SENSORS.

❑/_____ITEM NO.5: CHECK DISCHARGE AIR TEMPERATURE OFF OF ALL COOLING UNITS. (INCLUDE DISCHARGE AIR IN COOLING FOR EACH STAGE OF COOLING, MUST BE 56 DEGREES OR COOLER, REFERENCE START-UP FORMS)

❑/_____ITEM NO.6: CHECK DISCHARGE AIR TEMPERATURE AND HUMIDITY OFF OF ALL MAKEUP/OUTSIDE AIR UNITS. (MUST BE 53 DEGREES OR COOLER OFF COIL) WHEN MAU'S ARE PRESENT ON JOB.

❑/_____ITEM NO.7: LIGHITNG CONTROL TEST DOCUMENTATION : PROVIDE FACTORY START-UP AND PROGRAMMING OF 'NLIGHT' LIGHTING CONTROLS. PROVIDE DOCUMENTATION THAT THIS FACTORY PROGRAMMING HAS OCCURRED.

❑/_____ITEM NO.8: SURGE PROTECTION TEST DOCUMENTATION: PROVIDE DOCUMENTATION THAT MANUFACTURER ONSITE TESTING HAS BEEN COMPLETED FOR SURGE PROTECTION.

❑/_____ITEM NO.9: TRANSFORMER TEST DOCUMENTATION: PROVIDE DOCUMENTATION FOR TRANSFORMERS THAT MANUFACTURER HAS VERIFIED CONNECTIONS AND TESTED USB PORT FUNCTION. WHEN TRANSFORMERS PRESENT ON JOB.

❑/_____ITEM NO.10: VERIFY THAT MECHANICAL CONTROL SYSTEM IS COMPLETE.

- ENSURE THAT ACCESS TO CONTROLS IS CONNECTED AND OPERATIONAL.
- OWNER SCHEDULE HAS BEEN INPUT.
- ALL SEQUENCES OF OPERATION FUNCTION PROPERLY
- ALL CONTROL START-UP FORMS COMPLETED AND SUBMITTED.
- ENGINEER WILL REQUIRE ACCESS TO CONTROL SYSTEM DURING FINAL VISIT. PROVIDE ACCESS CODES AND PASSWORDS TO ENGINEER.

❑/_____ITEM NO.11: ELECTRICAL CERTIFICATE OF COMPLETION PER SPECIFICATIONS, INCLUDING ALL GROUNDING TESTING, MEGGER READINGS REQUIRED BY SPECIFICATIONS.

❑/_____ITEM NO.12: CONTRACTOR READINESS FORMS COMPLETE FOR EACH PIECE OF EQUIPMENT: (ATTACHED)

A. MECHANICAL UNITS – AHU, RTU, MAU

B. WATER HEATERS

❑/_____ITEM NO.13: AS-BUILTS PROVIDED.

❑/_____ITEM NO.14: O&M'S PROVIDED.

❑/_____ITEM NO.14: ALL PREVIOUS ITEMS IN ALL PREVIOUS REPORTS THAT HAVE NOT BEEN FIXED ARE STILL CONSIDERED OUTSTAND AND SHOULD BE FIXED WITH PHOTOGRAPHIC PROOF PROVIDED TO OWNER/ENGINEER/ARCHITECT, PRIOR TO GETTING PAYMENT FOR SUBSTANCIAL COMPLETEION.

Sign before requesting Final Inspection:
Signature of Person Completing Readiness Checklist. _____Date_____

THE CONTRACTOR SHALL RESPOND IN WRITING THAT ALL DEFICIENCIES HAVE BEEN CORRECTED. SEND RESPONSE BACK TO ARCHITECT.

SECTION 26 05 10 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall breakdown the final Schedule of Values to be used for pay application into the following minimum categories.

B. **ALL CATEGORIES SHALL HAVE APPROPRIATE MATERIAL AND LABOR BREAKDOWN.**

C. Final Payment will **NOT** be made until all required documentation is submitted with ALL deficiencies addressed.

D. Definitions:

1. Service: Conduit for utility company and conduit and wire from utility transformer to main switchboard.

2. Feeders: Include all conduit and wire serving transformers and panelboards.

3. Branch Circuit: Any circuit from a panelboard to a utilization device.

4. Gear: Main switchboard, panelboards, transformers, disconnects, etc.

5. Site conduit voice/data.

1.02 SCHEDULE OF VALUES

A. Mobilization

B. Interior Lighting Fixtures

C. Branch Circuit - Wiring and Conduit

D. Feeders - Wiring and Conduit

E. Devices (switches and receptacles)

F. Fire Alarm System

G. Testing/Labeling of Equipment

H. Factory Lighting Controls Start-up Documentation - ($10,000 minimum)

I. Wire Megger Testing Reports Documentation - ($10,000 minimum)

J. Record Drawings and O&M Manuals ($1500 minimum)

K. Signed and Completed - Certificate of Completion Documentation - ($10,000 minimum)

END OF SECTION

SECTION 26 05 19 - WIRE AND CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a complete system of conductors in raceway systems as shown on the drawings and hereinafter specified. Route all wire through an approved raceway unless otherwise indicated, regardless of voltage application.

B. Provide 200% neutral conductors only to panels with 200% neutral specified on plans. Reference Panel Schedules.

C. **Provide individual neutrals for each circuit, no shared neutrals allowed.**

D. **No de-rating of neutrals allowed.**

1.02 STANDARDS

A. Provide conductors in accordance with the applicable sections of UL and IPCEA Standards.

1.03 SUBMITTALS

A. Furnish Engineer shop submittals for each type of wire and cable.

B. Provide shop submittals which includes the following information:

1. Insulation type.

2. Insulation temperature rating.

3. Manufacturer

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wire and Cables: (600 Volts)

1. Provide copper wire and copper ground conductors **only**. Conductors shown on plans are thusly sized. **No aluminum conductors** will be allowed unless specifically noted.

a. Minimum wire size for branch circuits shall be #12, however, #14 may be used for motor control circuits where specified on the drawings.

b. All conductors #12 and smaller shall be solid and #10 and larger shall be stranded.

2. Provide copper conductors of annealed, 98 percent conductivity soft drawn copper. Provide stranded conductors for control circuits.

B. **Metal clad cable shall not be acceptable for lighting circuits except from junction box to light fixture, maximum 6 feet in length.**

1. **Type MC-PCS combination power/dimming metal clad cable is acceptable for use with the above limitation.**

C. **Metal-clad cable shall not be acceptable for receptacles.**

D. Roof mounted maintenance receptacles shall have circuit routed in “seal tight” or “carflex”. Must be used for all locations on roof, routing in RTU’s and on roof.

E. Insulation: (600 Volts)

1. Provide all conductor insulation types rated for wet and dry locations and approved by the National Electrical Code for the particular application. Provide all wire and cable with the following (or better) insulation classes:

a. All feeders and branch circuits are to be dual-rated Type THHN/THWN copper conductors.

b. Insulation rated for operation at 600 volts.

c. In areas where the temperature will exceed 167°F, provide wire rated 105°C. minimum and a type approved by the local code. Include any wiring within three feet (3’) horizontally or ten feet (10’) above any heating appliance.

2. Color code in accordance with the wiring diagrams furnished with equipment. All wiring for control systems to be installed in conjunction with mechanical and/or miscellaneous equipment. Color code by line or phase all branch circuit wiring including circuits to motors and feeders as follows: Wire No. 10 and smaller shall be factory color coded. Wire No. 8 and larger may be color coded by color taping within six inches (6”) of exposed ends. **Color coding for each nominal voltage shall be consistent throughout building from point of origination to the termination point including tap conductors to luminaire. Mixing of colors between voltages will not be allowed.**

120/208 Volt	277/480 Volts
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Yellow
Phase C - Blue	Phase C - Purple
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green

F. Wire and Cable: (50 volts or less)

1. Provide copper wire, minimum size #18 AWG for controls, #18 AWG minimum for fire alarm and #20 AWG minimum for communications. All wire and cable shall be solid. Stranded conductors are not acceptable.

2. All conductors shall be routed in conduit or shall have an insulation approved for plenum installation, unless otherwise noted.

G. ROMEX not allowed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Unless otherwise indicated, wiring size noted on the drawings extends for the entire length of a circuit. Install wire in raceways in strict conformance with the manufacturer's recommendations. Use a UL approved wire-pulling lubricant. Strip insulation so as to avoid nicking of wire.

B. Wire Connections and Devices:

1. Provide all terminating fittings, connectors, etc., of a type suitable for the specific cable. Make all fittings up tight. Make up all terminations in strict conformance with manufacturer's recommendations using special washers, nuts, etc., as required.

2. Connect No. 8 and larger wire to panels and apparatus with properly sized, solderless, or compression lugs or connectors.

3. Join No. 10 and smaller wire by twisting tight and applying UL listed twist-on connectors.

4. Leave at least an eight-inch (8") loop of wire for ends at each outlet box for the installation of fixtures or devices.

C. Flashover or insulation value of joints shall equal that of the conductor. Provide connectors rated at 600 volts for general use and 1000 volts for use within fixtures.

D. Grouping shall be 3 Hots and 3 Neutrals or 6 Hots max. Derating shall be based on the 90-degree chart of NEC 310-16 and table 310.15 (B)(2)(2).

E. Where the distance between the supplying panel and the first branch circuit receptacle, light fixture or equipment is more than 100 feet, upsize wire to allow for maximum of 3% voltage drop for actual routing of conduit to device.

F. Wiring for emergency systems shall be kept entirely independent of all other wiring and equipment as required by Article 700 of the NEC.

G. Mechanically protect conductors by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use an approved wire-pulling compound when pulling conductors. Wiring pulling compound shall be listed and as recommended by the conductor manufacturer. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of the insulated conductors. Do not exceed manufacturer's recommended values for maximum pulling tension.

H. Pull conductors simultaneously where more than one conductor is being installed in the same raceway.

I. Use pulling means including fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.

K. Neatly and securely bundle all conductors in enclosures using nylon straps with a locking hub.

L. At least 6 inches (measured from the finished surface) of each conductor shall extend outside a box's opening.

M. Conductors shall not be routed from panel to equipment above the roof deck. All conductors for roof mounted equipment shall be routed below roof deck to equipment roof opening or adjacent roof penetration.

N. For buildings with a smoke control system, per IFC 909.12.2, all wiring for all components of the smoke control system, regardless of voltage, shall be installed in a continuous raceway.

3.02 SPLICES AND TERMINATIONS

A. Splices shall be kept to a minimum.

B. Splices shall be made in junction and/or pull boxes.

1. Splices in conduit fittings (i.e., conduit bodies), and in panelboards are not acceptable.

C. All materials shall prevent corrosion or electrolysis between dissimilar metals.

D. Use terminal blocks within a junction box for all splices of No. 6 and larger conductors.

E. Use mechanical, crimp or compression type connectors for terminations of stranded conductors.

3.03 CONDUCTOR SIZING

A. Install conductor size required by the more stringent requirements of the drawings or specifications.

B. Install No. 10 AWG conductors the entire length of the circuit for single-phase, 120-volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 100 feet.

C. Install No. 10 AWG conductors the entire length of the circuit for single-phase 277 volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 200 feet.

D. General use circuit numbers may be changed. Equipment circuits have numbering to balance loads. This contractor is responsible for maintaining a balanced load and recording the actual circuit numbers.

E. Comply with ampacity adjustment factors as required by the NEC Article 310-16.

3.04 TESTING

A. Prior to energizing feeders, perform insulation resistance tests at 500 Volts D.C. for 30 seconds on each cable with respect to ground and adjacent cables. Maintain the following log for feeder tests:

FEEDER DESCRIPTION: _____

TESTER'S NAME: _____

TEST INSTRUMENT SERIAL #: _____

TEST DATE: _____

RESISTANCE: _____

A-B	A-C	A-G	B-C	B-G	C-G

B. Test all circuits for proper neutral connections.

C. Upon completion of all testing, prepare a detailed report of all voltage and insulation resistance measurements. Deliver report to Engineer with request for final inspection.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide copper clad 5/8" x 8 ft. - 0" long ground rods, appurtenances, bonding plates, clamps, connectors and grounding conductors as required. Furnish rods to which the copper cladding is permanently and inseparably bonded to a high strength steel core.

2.02 CONNECTORS

A. Provide exothermic weld type ground connections for concealed, underground, and concrete encased ground connections.

B. Exposed connections may be made with copper or bronze bolted or compression lugs.

2.03 INTER-SYSTEM GROUNDING BUS-BAR (communications)

A. Provide surface mounted terminal blocks sufficient to except 20 individual conductors of sizes 14 AWG thru 4 AWG.

2.04 2.04 CONDUCTORS

A. Furnish copper conductors.

B. Furnish 600-volt, insulated conductors for equipment grounding.

C. Size the system grounding electrode conductors to comply with NEC section and table 250-66, unless shown larger.

D. Size the main and separately derived system bonding jumpers to comply with NEC section 250-28 (D).

E. Size equipment grounding conductors to comply with NEC section and table 250-122, unless shown larger.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Properly ground all service equipment conduit systems, supports, cabinets, equipment, motor frames, fixtures, etc., and the grounded circuit conductor in accordance with the latest issue of the National Electrical Code. Provide all bonding jumpers and wire, grounding bushings, clamps, etc., as required for complete grounding. Route ground conductors to

provide the shortest and most direct path to the ground electrode system. Bond conduit if made of current conducting material. All ground connections shall have clean contact surfaces. Bond the service equipment to a grounding electrode as shown on the Drawings.

B. Provide a grounding type bushing for all feeder and branch circuit conduits which do not have a grounding conductor and individually bond this raceway to the enclosure's ground bus or lug.

C. Provide a grounding type bushing on the end of each isolated section of metal conduit and bond the conduit to the equipment grounding conductor, or using a conductor of the same size, bond directly to the equipment ground buss of the equipment at the end of the run.

D. Make single or dual connections to ground rods, plates, and other buried connections by the exothermic process (Cadweld) or Burndy Hyground TM Compression Systems and "hammer tested" to ensure that a good bond has been made. Alternatively, all below grade compression grounding systems must meet all UL467, CSA, IEEE837 test requirements and conform to the National Electrical Code Standards. The material at the connectors shall be pure wrought copper extrusions, rod and seamless tubing and be identical material to the conductor. Connectors must be of heavy-duty design and be of range taking design to accept conductor ranges of #6 solid to 500 Kcmil plus 5/8" ground rods. Compression connectors need to be compressed with system engineered tooling which makes a circumferential or round crimp. Hex crimp is not acceptable due to sharp flashes and spurs that may occur. Each connector must be clearly marked with catalog number, conductor size and installation die information. Inspection ports must be provided on lug terminations and splices. The system must emboss all the appropriate die index numbers on all connectors after completion of the crimp. Connectors must be prefilled with penetrox copper type oxidation inhibitor and be individually sealed in clear polyethylene sheet to keep out dirt and contamination.

E. Drive grounding electrodes as required. Where rock is encountered, grounding plates of copper, 1/4-in. x 24-in. x 24-in may be used in lieu of grounding rods. Plates must be installed at 36" minimum below finished grade.

F. Connect grounding electrode conductor to building steel and metallic waterline per NEC 250-81. Allow a minimum of 25 feet of grounding conductor in foundation footing and make 3 connections to Rebar. Connections shall utilize an acceptable compression method with connectors listed for contact with respective metal types.

G. Provide a grounding terminal pad in all panelboards, switchboards, and other electrical equipment.

H. Directly ground to the work piece welding machines used in construction. The use of the building or equipment steel or conduits of any kind as a common ground point is not allowed under any conditions. Contractor is responsible for any electrical pieces of equipment damaged by not using the welder grounding method described above.

I. Provide a green insulated grounding conductor in all conduit serving receptacles and/or equipment. Refer to panelboard schedules for sizing.

J. Ground all receptacles to outlet box with a conductor.

K. Flexible conduit will not be allowed as a grounding means.

L. Install metallic fittings on clean contact surfaces to ensure electrical conductivity.

M. Tighten connectors, terminals, screws and bolts, in accordance with manufacturer's published torque tightening values or comply with torque tightening values specified in UL 486A to assure permanent and effective grounding.

N. Apply a corrosion-resistant finish to places where factory applied protective coatings have been damaged.

O. Protect all exposed, grounding electrode conductors with Schedule 40 PVC nonmetallic conduit.

1. Grounding electrode conductors shall not be protected with metallic materials.

3.02 GROUNDING ELECTRODE SYSTEM

A. At each building's service or disconnecting means, install a grounding electrode system which includes:

1. A concrete encased electrode connected to the concrete reinforcing bars and

2. The building structural steel and

3. The building's metal underground (10 ft.) water pipe.

a. This connection must be within the first 5 ft. of the water pipe's entrance into the building. Water piping cannot be the sole ground and must be supplemented.

4. Other electrodes such as a rod, plate or ring may be used to supplement but cannot be used as a substitute.

B. At each grounded separately derived system, install a grounding electrode conductor to connect the grounded (XO-neutral) conductor to:

1. The nearest one of the following electrodes:

a. An effectively grounded structural steel member or

b. An effectively grounded metal underground (10 ft.) water pipe.

1) This connection must be within the first 5 ft. of the water pipe's entrance into the building.

2. If neither of these is available, install a 3/0, copper, common grounding electrode conductor from the building's service or disconnecting means. Connect taps from this common grounding electrode conductor to the separately derived system's grounded (XO-neutral) conductor.

3.03 SYSTEM BONDING

A. SERVICES

1. Install a main bonding conductor between the service ground bus and the grounded (neutral) bus-bar.

B. SEPARATELY DERIVED SYSTEMS

1. Install a bonding jumper between the equipment ground bus and the separately derived electrical system's (transformer, UPS, central battery/inverter or generator) grounded (XO-neutral) bus.

3.04 ADDITIONAL BONDING

A. Install 3/0 AWG bonding jumpers around all structural metal expansion joints.

B. Each building's interior metal water piping system which does not qualify to be used as a grounding electrode shall be bonded to the building's service or disconnecting means.

C. Bond the grounded (XO-neutral) conductor of each separately derived system to the nearest available point of the interior metal water piping system(s).

1. When the structural steel is being used as the grounding electrode for the separately derived system, the interior metal water piping system(s) may be bonded to the structural steel.

D. Install bonding jumpers around raceway expansion joints.

E. Install bonding jumpers around insulated water pipe joints.

F. Install a bonding jumper between all grounding electrodes used for communications, radio and television or antenna systems and the building's grounding electrode system.

3.05 COMMUNICATION GROUNDING

A. Provide a surface mounted, inter-system grounding bus-bar at the service equipment or a separate building's disconnecting equipment and in each communications room.

B. At the service or separate building's disconnecting means, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the equipment ground bus.

C. At communications rooms, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the building's structural steel.

3.06 EQUIPMENT GROUND

A. Raceways shall not be used as the sole equipment ground.

B. Bond the equipment grounding conductors to all boxes and enclosures.

C. Each receptacle shall be bonded to its respective device box. The connection shall be made by means of a bonding jumper between the device and the box. Where the receptacle mounting yoke is designed and listed for the purpose of grounding, the bonding jumper may be omitted. This does not substitute for the need of grounding the outlet box.

D. Each isolated ground receptacle shall have an isolated ground conductor installed complete from receptacle to the isolated ground bus in the panelboard. No other grounding connections shall be made to these receptacles, specifically connections to the device box or raceway system.

3.07 POOL GROUNDING/BONDING

A. Electrical Contractor shall coordinate all equipment grounding, equipotential grounding/bonding, bonding, and all connection requirements to pool equipment, building steel, concrete rebar, any other metal components in pool area with pool equipment installer and pool installer. Provide connections and bonding/grounding to all electrical equipment in and around pool per NEC article 680. Provide pictures of grounding/bonding wire prior to concrete or pool concrete being poured, for records.

3.08 TESTING

A. Following completion of installation, test system ground for continuity and test resistance to ground by “fall of potential” method and all feeders or sub-feeders with appropriate meggers, or other approved instruments and methods, to determine ground and insulation resistance values.

B. Submit logs of values obtained, nameplate data of instruments used and instrument calibration data prior to final inspection. Instruments used are subject to acceptance.

END OF SECTION

SECTION 26 05 29 – HANGER & SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all required supporting devices, including but not limited to channels hangers, brackets, fittings, clamps, hardware, anchor bolts, rods, electrical accessories, etc., for conduit and equipment.

1.02 STANDARDS

A. Conform with the latest requirements of the NEMA and The National Electric Code.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Support Channel: Hot-dipped galvanized steel, sized for load, minimum size 12 gauge, 1-5/8 wide by 13/16 deep. Furnish fasteners sufficiently sized to carry load imposed.

B. Hardware: Corrosion Resistant (Hot-dipped galvanized all steel components)

C. Support Wires (16 Ga. Minimum) and Tie Wires (22 Ga. Minimum) or as required by UL listed assemblies: Galvanized Steel

D. Coatings: All steel components shall be hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Perforated iron straps are not permitted for supporting conduits. Conduits run between the webs of bar joists may use galvanized tie wire for securing the conduits. Cut excess wire and bend ends to prevent sharp ends.

B. Support horizontal and vertical conduit runs by one-hole straps, clamp-backs or other acceptable devices and suitable bolts. All conduits shall be secured to structure with supporting devices dedicated for the electrical system and/or conduits for systems furnished under the Electrical Contractor responsibilities. When two (2) or more conduits are run parallel, they may be supported on trapeze hangers, equal to the Modern Co. Other hangers shall be constructed with rods and hanger adjusters of adequate size to carry the loads imposed.

C. All conduits shall be supported a maximum of ten feet (10’) on center. Also, support conduits within twelve inches (12”) of any bends, outlet boxes, wall penetrations or joints in pipe. All conduits shall be secured to structure. Lighting fixture whips may not be secured to ceiling tie wires. Vertical risers shall be supported by approved riser clamps or supports installed at the respective floor lines.

D. Conduits routed below bar joists shall utilize acceptable clamps.

E. Fasten hanger rods, conduit clamps and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, or beam clamps. Do not use spring steel clips and clamps. Submit method of attachment for review prior to commencing work.

F. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheetmetal screws in sheetmetal studs; and wood screws in wood construction.

G. Do not fasten support wires to piping, ductwork, mechanical equipment, or conduit.

H. **Do not fasten conduit or junction boxes to ceiling grid wire. All conduit must be independently supported.**

I. Support recessed fluorescent light fixtures with support wire at all four corners as required by roof/ceiling assembly. If roof/ceiling assembly does not require supports at each corner, support fixtures with minimum of two support wires at diagonally opposite corners. Spray paint ends of fixture support wires orange.

J. Conduits, except as approved by NEC, shall not be used to support low voltage cables.

K. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for conduit 2-1/2" and smaller. For conduit over 2-1/2", up to and including 4" use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All conduit stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 3-1/2"). Provide supports for piping under 2" at six feet on center. Provide supports for conduit 2" and over at eight feet on center.

L. Provide all angles, unistrut supports and threaded rods under any structural elements or mechanical equipment where required for proper placement and support of light fixtures and/or conduits.

M. Supports and hangers shall be installed to permit free expansion and contraction in the raceway systems. Where necessary to control expansion and contraction, the raceways shall be guided and firmly anchored. Anchors shall be approved by the Engineer and shall be designed for equal effectiveness for both longitudinal and transverse thrust. No conduit shall be self-supporting, nor shall it be supported from equipment connections. Transmission of vibrations, noise, etc., shall be considered and any special suspension with vibration dampers to minimize transmission shall be used where necessary.

N. Where ducts interfere with the proper location of hangers, furnish and install trapeze hangers. Trapeze hangers may be used to support groups of conduit run in parallel.

O. Install metal framing to support wall mounted equipment and wall or ceiling mounted raceways.

P. Install expansion bolts to attach framing to concrete. Space bolts a maximum of 24 inches on center, with not less than two bolts per piece of framing.

Q. Touch up all scratches or cuts on steel components with an approved zinc chromate or a 90 percent zinc paint.

END OF SECTION

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a complete conduit system as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

A. Conform with the latest requirements of the NEMA, the National Electrical Code, and be UL listed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rigid Metal Conduit (RMC): Hot-dip galvanized, threadable steel raceway, galvanized after fabrication. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.

B. Intermediate Metal Conduit (IMC): Conduit shall be similar to rigid steel conduit except thinner wall. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.

C. Electrical Metallic Tubing (EMT): EMT shall be made of hot-dip galvanized strip steel. Fittings shall be steel or die cast compression or set screw type.

D. PVC - Schedule 40 and Schedule 80 polyvinyl chloride conduit (PVC Duct) shall be UL rated. Conduit fittings and cement shall be produced by the same manufacturer and approved for such use.

E. Flexible Metal Conduit (FMC): Spirally wound continuously interlocked zinc coated strip steel. Fittings shall be steel or die cast zinc, either screw-in or squeeze type.

F. Flexible Conduit (LFMC): Liquid-tight (vibration and/or wet areas) fabricate from continuous lengths of spirally wound galvanized steel strip interlocked with a gray polyvinyl chloride cover extruded over the core to make the conduit liquid tight, oil proof and bendable to a small radius. Fittings shall be compression type, steel or die cast zinc, with insulated throat.

G. Metal-Clad Cable (MC): Galvanized interlocking steel armor. 600-volt, type THHN/THWN, integrally colored insulation. Size #12 AWG or #10 AWG, copper conductors. Fittings shall be listed for MC usage and include anti-short bushings. Reference Section 3.03 for acceptable uses.

H. Metal Wire-ways.

1. Furnish with wire retainers on not less than 12-inch centers. All screws installed towards the inside shall be protected to prevent possible wire insulation damage.

2. The finish shall be the manufacturers' standard color and shall consist of not less than two coats of enamel over a rust-inhibiting prime coat.

I. Surface Metal Raceway (2000 series).

1. Surface metal raceway shall consist of a single compartment base, blank cover, and appropriate fittings to complete the installation per the electrical drawings.

2. The base and cover shall be manufactured of steel and finished with a white color.

3. Approximately ¾" deep, 1 ¼" high and 5' sections.

J. Non-Metallic Multi-outlet Assemblies (5400 series).

1. Surface raceway system shall consist of a dual compartment raceway base, twin cover, appropriate fittings, outlets and device mounting plates necessary for a complete installation.

2. Duplex receptacles and data outlets ("activate connectivity inserts") mounted at 24" centers or as noted on plans. Connect adjacent receptacles on alternate circuits.

3. Approximately 1 ¾" deep, 5 ¼" high and 8' sections with equal compartments.

4. The finish shall be white color and shall consist of not less than one coat of enamel over a prime coat.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Raceway and cable usage and installation shall conform to the appropriate article of the National Electrical Code (NEC), as a minimum.

B. Do not install conduit that is crushed or deformed in any way.

C. Provide a nonmetallic (nylon, polypropylene, or approved equal) drag line of suitable strength in spare conduits and telephone conduits. Tightly plug spare conduits at both ends.

D. Do not pull wire into conduit system until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed.

E. No wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors.

F. No wiring system of any type shall be installed in any shaft containing ducts used for vapor removal or for ventilation of commercial-type cooking equipment.

G. Fasten and support the wiring method employed to the permanent structure using listed straps with corrosion resistant hangers and fasteners.

H. Ceiling system wires or lay-in type ceiling grid components shall not be used as a means of support.

1. Independent support wires and associated fittings which are installed in addition to the ceiling system support wires, shall be permitted: (300.11.A)

2. Independent wires within the cavity of a fire-rated floor–ceiling or roof–ceiling assembly shall be distinguishable by color. (300.11.A.1)

3. Independent support wires that provide support for device boxes shall be secured at both ends. (300.11.A).

I. Bends shall be made with factory elbows or field bent. Field bends shall be made using equipment designed for the particular raceway material and size. Bends shall be free from dents or flattening.

J. Conduit bodies may be used in lieu of conduit elbows where covers will be accessible, and ease of installation and appearance warrants their use.

K. Install expansion-deflection fittings where raceways cross structural expansion joints or where required to compensate for soil deflection or thermal expansion and contraction. Install bonding jumpers across expansion-deflection fittings in metal raceway systems.

L. Openings through fire-resistant-rated or sound-resistant-rated walls, partitions, floors or ceilings shall be fire-stopped by installing raceways or cables through sleeves set through the walls, partitions, floors or ceilings and fire-sealing all openings and voids around the sleeves, raceways and cables.

M. Do not drill or pierce structural steel members under any circumstances without the Engineer’s specific approval.

N. Minimize roof penetrations by routing conduit through the equipment roof opening. If roof penetration is necessary, coordinate with the Architectural Specifications and penetrate as directly below the equipment disconnect or wiring connection point as possible. Do not use flexible conduit in a pitch pan.

O. Conduit shall not be routed from panel to equipment above the roof deck. All conduit for roof mounted equipment shall be routed below roof deck to equipment roof opening or adjacent roof penetration.

P. Arrange all conduits to drain away from the building.

Q. Perform all necessary excavation and backfilling. Tamp backfill in six-inch (6”) layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. Provide shoring, bracing, and de-watering as necessary. Remove all excess and materials not suitable for backfill from the site. Provide barricades to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.

R. A tracer tape wire shall be installed in all trenches which do not contain conductive conductors within them. This will include future use raceways, optical fiber, etc.

S. Raceway systems shall be complete before installing conductors.

T. The interior of all raceways shall be cleaned before installing conductors.

U. Terminate future use raceways with a capped coupling within an accessible area.

V. Unless otherwise noted, all conduits are expected to be concealed inside walls or above ceiling. In areas with open ceilings that require exposed conduits, all conduits shall be routed perpendicular or parallel to building lines with final routing approved by the architect or engineer prior to installation.

W. In locations where Type MC cable is approved for installation in Specification 26 05 19 and in this specification, it shall be installed in a neat and workmanlike manner. Cable shall not cross other cable or have excess slack. Cable that is installed vertically, must be plumb with the vertical framing of the structure.

X. Bundling of cable is limited to three cables for each support ring.

Y. Type MC cable may be only supported by fasteners or clamps that are approved and UL tested for cable support.

Z. For buildings with a smoke control system, per IFC 909.12.2, all wiring for all components of the smoke control system, regardless of voltage, shall be installed in a continuous raceway.

3.02 INSTALLATION BELOW GRADE

A. Minimum size raceway is 3/4 inch.

B. Provide rigid galvanized steel conduit or PVC where conduits are installed in concrete floor slab ¾" maximum. Maintain proper concrete coverage as directed by structural engineer. PVC conduit shall not penetrate slab above finished grade.

C. Provide rigid galvanized steel or PVC conduit where conduits are installed below grade.

D. Swab clean all conduits before cable installation. Waterproof all conduit joints after cable installation.

E. Provide conduit wall sleeves for all conduits penetrating walls, grade beams, etc. and other locations shown on the Drawings.

F. Where required to bend PVC ducts to satisfy indicated routing, preform ducts to allow ends of duct sections to be in a straight alignment. Accomplish preforming of ducts by utilizing proper duct heater units.

G. Perform all necessary excavation and backfilling for proper installation of work. Take precautions not to excavate below depth required. Backfill trenches with sand, 3" below conduits and 3" above. Tamp remainder of backfill in six-inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. In areas to be paved, compact to density to receive pavement. Where pavement is broken for the installation of conduit, repair to original condition. Provide shoring, bracing, and de-watering, if necessary, for installation of work. Remove from site all materials encountered which are not suitable for backfill.

H. When and if damage is caused to underground utility lines or structures, above ground utility lines or structures, or other purposeful surface conditions, either on or off the right-of-way, make immediate temporary repairs. At the first opportunity, make permanent repairs which are acceptable to the Owner. All such repairs shall be made at the Contractor's expense.

I. Where necessary, provide barricades around open excavations to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.

J. Where conduits embedded in concrete floor or roof deck cross expansion joints, they shall be joined together using O.Z. Gedney type DX expansion fittings and bonding jumpers. Straight runs of conduit over 150' long shall have O.Z. Gedney Type AX expansion fittings installed to minimize movement. Fittings shall be installed at a maximum of 150' on center.

K. Where horizontal runs of conduit transition to vertical and continue above finished grade or finished floor; the transition shall be made with a 90-degree long radius sweep. The sweep may be PVC (2" and smaller) and shall be RMC (2-1/2" and larger). No PVC conduit will be allowed above finished grade or finished floor except where Schedule 80 PVC is specifically required by the electric utility for service conduits only.

L. **CONDUITS RUN BELOW FINISHED FLOOR SHALL NOT PENETRATE GRADE BEAMS. UNLESS APPROVED BY STRUCTURAL ENGINEER.**

3.03 PERMITTED RACEWAY USAGE:

A. Raceway transitions at all locations:

1. Rigid nonmetallic conduit runs from below grade level shall transition to galvanized rigid steel or intermediate steel conduit, wrapped with corrosion protection tape, prior to exiting at grade level except where Schedule 80 PVC is specifically required by the electric utility for service conduits only. Conduit type shall continue thereafter in accordance with their usage requirements.

a. Caulk concrete-to-conduit joints with a silicone rubber compound.

2. Continue the more protective conduit type into an area where a less protective conduit type is permitted for a distance of not less than 1 foot.

B. Electrical metallic tubing at:

1. Interior locations when:

a. Concealed within walls and ceilings or **do not use in the mortar filled cells of concrete masonry units.**

b. Exposed and more than 8 feet above finished floor or

c. Exposed and more than 3 feet above finished floor in electrical or mechanical rooms or

d. Exposed and more than 1 foot above a finished attic or mezzanine floor.

e. Do not use where exposed to standing water or other continuously damp or wet areas.

2. Exterior locations when:

a. More than 10 feet above the finished ground surface or

b. More than 1 foot above the finished ground surface within a lockable equipment yard or

c. In the crawl space below a building with the 1st level elevated.

C. Rigid or intermediate metal conduit at:

1. Interior locations when:

a. Exposed, in other than electrical or mechanical rooms, and installed less than 8 feet above finished floor or

b. Exposed in electrical or mechanical rooms and installed less than 3 feet above finished floor or

c. Exposed and less than 1 foot above a finished attic floor or mezzanine floor.

2. Exterior locations when:

a. Less than 10 feet above the finished ground surface or

b. Less than 1 foot above the finished ground surface within a lockable equipment yard.

1) Malleable iron straps will be required at these locations.

D. Rigid metal and intermediate metal conduit wrapped with corrosion protection tape or rigid nonmetallic conduit at:

1. Underground locations with a ¾" minimum size when:

a. Located outside of the building line or

b. Located below a concrete slab on grade or

c. Located below a beam of a slab on grade or.

d. Located within a concrete slab on grade where the outside diameter is equal to or less than 20 percent of the slab thickness.

1) Seal conduit ends at each building entry.

2. Below grade:

a. The minimum size shall be 3/4 inch.

b. Seal conduit ends at each building entry.

c. Coordinate covering with Structural Engineer.

E. Rigid nonmetallic conduit for:

1. An exposed grounding electrode or bonding conductor below 10 ft. to guard from physical damage.

F. Flexible metal conduit in:

1. Dry interior locations with a minimum length of 2 feet and maximum length of 6 feet to:

a. The final connection of transformers, motors, and vibrating equipment.

G. Flexible metal conduit or metal-clad cable for light fixtures or ceiling mounted devices.

1. Dry or damp interior locations with a maximum length of 6 feet to:

a. The final connection of light fixtures; or

b. The final connection of ceiling mounted outlet boxes or.

H. Flexible metal conduit is not allowed for any technology rough-in, must be EMT.

I. Liquid-tight flexible metal conduit in:

1. All locations with a minimum length of 2 feet and maximum length of 6 feet for

a. The final connection of all liquid pump motors and associated control connections or

2. Damp or wet interior and all exterior locations with a minimum length of 2 feet and maximum length of 6 feet to

a. The final connection of transformers, motors, and vibrating equipment.

END OF SECTION

SECTION 26 05 34 - OUTLET BOXES, PULL BOXES AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide outlet boxes in accordance with the National Electrical Code at locations shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.01 MATERIALS

A. **Provide standard hot-dipped galvanized pressed steel boxes, minimum 4”x4” by 1-1/2” deep. Use 4 11/16” by 2 1/8” deep box when using 1” conduit.**

B. Cabinets with screw covers or as specifically noted for junction or pull boxes larger than 150 cubic inches.

C. All junction, pull and splice boxes to conform to NEC Article 314.

D. All metallic boxes are to have an internal means of grounding.

E. Flush mounted wall and finished ceiling boxes.

1. Within framed, drywall, plastered or tile covered walls, with ¾” max. raceway, furnish galvanized steel, 4” square, minimum 1 1/2-inch-deep boxes with a raised tile cover and a far-side support.

2. Within drywall or plaster covered or suspended ceilings, with ¾” max. raceway, furnish galvanized steel, 4” square, minimum 1 1/2-inch-deep boxes with a raised tile cover.

3. Within masonry walls, with ¾” max. raceway, furnish galvanized steel boxes, minimum 2-1/2-inch deep.

F. Surface mounted boxes.

1. Mounted at or below 10’ above the finished surface, ¾” max. raceway size, furnish cast aluminum boxes with a surface mounted cover.

G. Junction and Pullboxes.

1. Furnish, minimum 4” square, 1 – ½” deep, galvanized steel junction and pullboxes where installation conditions warrant their use. Boxes shall be furnished with screw-on covers or hinged covers. Covers shall be such that it can easily be handled by one person. All hardware and fasteners shall be galvanized steel.

H. Flush mounted floor boxes.

1. Furnish adjustable, concrete tight, corrosion resistant, duplex type. Compartmental type for combination receptacle and communication. The coverplate shall be brass with hinged flap and carpet flanges. The minimum below ground/slab conduit size shall be ¾".

I. Underground boxes.

1. U. L. listed.

2. Pre-cast, polymer concrete.

3. Minimum size of 10" W X 10" L X 10" H.

4. Bolt down cover.

5. Stainless steel hex-bolts and replaceable nuts.

6. Minimum load rating of 5,000 lbs. (select by location)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Through wall boxes and boxes mounted back-to-back are not permitted. Provide 8 inch minimum separation in order to minimize sound transmission.

B. Set flush with wall or ceiling finish in accordance with N.E.C., Article 314. Extension sleeves are not permitted for boxes improperly set.

C. Verify location of outlets prior to rough-in. When necessary, relocate outlets to avoid interference with other work or equipment. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers.

D. Where more than one (1) switch or device is located at one (1) point, unless otherwise indicated, provide gang boxes and covers. When the voltage between switches exceeds 300 volts, provide barrier partitions between adjacent switches located in the same box. Sectional switch boxes or utility boxes not permitted.

E. Provide pressed steel boxes for all interior work. Provide square boxes with plaster rings. Provide appropriate size multi gang box for group devices. Single gang boxes screwed together is not acceptable.

F. Where boxes are installed in masonry walls, use only approved masonry type boxes for single gang and multi-ganged applications. Standard 4" square boxes with plaster rings are not allowed. Caulk around joint between receptacle box and masonry. Verify color with architect.

G. Do not drill and pierce structural concrete members and structural steel without prior approval of the Engineer.

H. Mount all boxes plumb.

I. Mount boxes completely rigid without conduit or finished wall support.

J. Where outlets are installed in steel stud type systems, provide additional cross bracing, bridging, and/or straps as required to make the outlet completely rigid. Support boxes with “caddy screw gun brackets”, “caddy box mounting bracket”, “caddy quick mount box brackets” or acceptable alternates.

K. **Dimensions are from finished floor to centerline of devices.** Adjust heights of devices in masonry walls from that indicated so that receptacles are not lower than 16” A.F.F. and switches are not higher than 46” A.F.F. Adjusted device height shall be consistent. Unless otherwise indicated, mount devices at the following heights:

Wall switches/Wall Phone	3 ft. - 8 in.
General Duplex receptacles	1 ft. - 6 in.
Receptacles at Millwork	verify with millwork
Receptacle for Refrigerators	2 ft – 6 in.
Weatherproof duplex receptacles	1 ft. - 6 in.
Telephone/Data outlets/Teacher Station	1 ft. - 6 in.
Telephone/Data at millwork	verify with millwork
Garages/Apparatus Bay receptacles	2 ft. - 0 in.
Clocks	8 ft – 0 in
Access Point Data Drops (wall mounted)	10 ft – 0 in

L. For boxes installed above ceilings, label the box cover with the circuit numbers installed. Labeling shall be with a permanent, black marker with broad tip.

M. Boxes installed in rated walls shall have a minimum horizontal separation of 24”. Maximum surface area of boxes shall not exceed 16 square inches.

N. Completely envelope floor boxes in concrete except at the top. Increase slab thickness at boxes if required for bottom covering. Adjust covers flush with finished floor.

O. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall.

P. Install recessed boxes flush to the finished wall or ceiling line by the use of manufactured tile rings to extend the box forward.

Q. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.

R. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture.

S. Install knockout closures to cap all unused openings.

T. All boxes shall be installed with coverplates.

U. Install boxes as required to facilitate conductor installation in raceway systems. Junction and pull boxes shall be sized to accommodate conductors, splices, devices and fittings per NEC 314.16.

V. Raceways are NOT allowed to terminate to extension rings.

W. Install boxes so that covers are accessible and easily removable after completion of the installation. The minimum clear space in the direction of the box opening shall be 36".

X. Include suitable access doors, with the proper fire rating, for boxes above inaccessible ceilings. Boxes shall be located within reach of the access.

Y. Install underground boxes with cover slightly above finished grade.

Z. **Spray paint J-Boxes red for Fire Alarm Systems. All other special system J-Boxes to be painted white.**

END OF SECTION

SECTION 26 05 80 - EMPTY RACEWAY ROUGH-IN

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install all equipment, accessories and material required for the rough-in of empty raceway systems in accordance with the specifications and drawings.

B. Rough-in raceway sections for indicated devices and outlets in all walls, floors and underground sufficient to facilitate installation of the following systems without cutting or otherwise damaging walls, ceilings or floors installed in this contract:

1. Communications

2. Fire Alarm

3. Television

4. Data

5. Security

6. Controls

C. **ALL** CONDUITS SHALL HAVE A PULL CORD INSTALLED. INSTALL BLANK COVERS ON ALL UNUSED JUNCTION BOXES.

D. 3/4" CONDUIT MINIMUM.

E. Electrical Contractor shall provide all conduit, junction boxes and outlet boxes for HVAC controls as specified in Section 26 05 00, 1.03, E. Coordinate locations and requirements with Mechanical Contractor and Controls Contractor prior to rough-in. Provide outlet box for sensor and conduit to above accessible ceiling. Provide conduit for all wiring in areas with no ceiling. Provide conduit from outdoor units to above accessible ceilings. Provide conduit between make-up air units and associated condensing units.

F. **REFERENCE TECHNOLOGY DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS CONCERNING CONDUIT ROUGH-IN FOR VOICE/DATA SYSTEMS.**

G. Floor mounted devices: Provide pathway to nearest accessible ceiling for all floor mounted devices called for in this specification.

H. Unless otherwise noted, all conduits are expected to be concealed inside walls or above ceiling. In areas with open ceilings that require exposed conduits, all conduits shall be routed perpendicular or parallel to building lines with final routing approved by the architect or engineer prior to installation.

1.02 QUALITY ASSURANCE

A. Construct each item of equipment, including parts and accessories, in a workmanlike manner, using new materials or the best quality obtainable for the purpose intended. Design and build materials in accordance with the best practices of the electrical industry.

B. Comply with all requirements of serving utility.

PART 2 - EXECUTION

2.01 INSTALLATION

A. Interior conduit systems shall have runs less than 100 feet from point to point.

B. Provide accessible pull boxes when necessary. Provide blank covers for all outlet boxes, unless otherwise noted.

C. All bends for telephone and cable television service shall be 36-inch radius, minimum.

D. Provide outlet box in wall at 18" A.F.F. (UON) and conduit with string to above accessible ceiling location. Provide insulated bushing on end of conduits.

E. **Provide twelve (12) additional outlet boxes and conduit with pull cord to above the ceiling. Final location shall be as directed by the Architect. Outlets can be added at any phase of construction with the exception of finished CMU walls.**

END OF SECTION

SECTION 26 15 00 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Electrical demolition.

PART 2 - EXECUTION

2.01 EXAMINATION

A. Demolition Drawings are based on field observations and existing Record Documents. Report discrepancies to Architect/Engineer before disturbing existing installations.

B. Verify field measurements and circuitry arrangements prior to starting demolition.

C. Verify that wiring and equipment to be abandoned serve only abandoned facilities.

D. Beginning of demolition means the Contractor accepts existing conditions.

2.02 PREPARATION

A. Disconnect electrical systems in walls, floors, ceilings, etc. scheduled for removal. Reference Architectural drawings and specifications for limits of demolition.

B. Coordinate utility service outage with Utility company and the Owner, prior to starting demolition.

C. 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.

2.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove abandoned wiring, conduit and appurtenances to source of power (panelboard) or previous device, including conduits, wiring and appurtenances above accessible ceilings.

B. Remove, relocate and extend existing installations to accommodate new construction.

C. Cut conduit flush with walls and floors, and patch surfaces. Reference Architectural Specifications for repairing and painting requirements.

D. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

E. Maintain access to existing electrical installations which remain active. Modify installation or provide access panels, as required.

F. Extend existing installations, as required, using materials and methods as specified or that is compatible with existing electrical installation.

2.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which are to be reused.

1. Panelboards: 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 circuitry arrangements.

2. Luminaires: Remove designated existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace all ballasts, lamps and broken electrical parts and/or lenses, as required.

END OF SECTION

SECTION 26 27 26 - DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide switches and receptacles as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

A. Provide all receptacles which conform with NEMA standards for amperage and voltage classification.

B. Provide devices U.L. listed for the application and for the type of wire used.

1.03 ACCEPTABLE MANUFACTURERS

A. Hubbell, Leviton, LeGrand or approved equal

1.04 SUBMITTALS

A. Furnish Engineer shop submittal for each device.

B. Provide shop submittals which include the following information:

1. Manufacturer and catalog number.

2. NEMA configuration.

3. Voltage and amperage ratings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Straight Blade Receptacles: Furnish Leviton receptacles or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Single receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

2. Single receptacle, 20 amp, 250-volt, 2-pole, 3-wire, grounding, NEMA 6-20R.

3. Duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

4. Tamper resistant, duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

B. Toggle Switches: Furnish Leviton switches or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Single pole, single throw, 20-amp, 120/277 volt.

2. Single pole, double throw, momentary, 20-amp, 120/277 volt.

3. Single pole, double throw, maintained, 20-amp, 120/277 volt.

4. Double pole, single throw, 20-amp, 120/277 volt.

5. Three-way, single throw, 20-amp, 120/277 volt.

6. Four-way, single throw, 20-amp, 120/277 volt.

C. Locking Switches: Furnish Leviton switches with #55500 key, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Single pole, single throw, 20-amp, 120/277 volt.

2. Single pole, double throw, momentary, 20-amp, 120/277 volt.

3. Single pole, double throw, maintained, 20-amp, 120/277 volt.

4. Double pole, single throw, 20-amp, 120/277 volt.

5. Three-way, single throw, 20-amp, 120/277 volt.

6. Four-way, single throw, 20-amp, 120/277 volt.

D. NLight Lighting Control Devices: Provide white devices as standard with stainless steel device plate. **(Devices on emergency circuits to have red plates and white devices).**

E. Dimmer Switches: Furnish Lutron NT series, or equivalent, continuously adjustable slide dimmer with preset on/off switch. Dimmer shall be solid-state type for use with 120-volt incandescent lamps and shall have electromagnetic filters to eliminate noise, RF and TV interference. Dimmer wattage is indicated on the drawings or 1000 watt minimum.

F. Ground Fault Devices: Color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Ground fault circuit interrupter (GFCI), 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

2. Ground fault feed through switch, 20 amp, 125-volt.

G. Device Plates:

1. Unless otherwise indicated, provide smooth metal device plates of Type 430 stainless steel for all indoor devices. Verify color with architect prior to ordering. Cover plates for devices served by emergency circuits shall be red.

2. Provide telephone and data outlets with blank metal type 430 stainless steel covers.

3. Provide properly gasketed vertical single lift device plate of aluminum die cast for weatherproof receptacles and/or switches.

H. Floor Outlets:

1. Provide where shown on the drawings, PVC rectangular floor boxes. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.

2. Receptacle floor outlets specified as duplex shall have duplex screw cap coverplates. Telephone and/or data floor outlet boxes to have combination screw cap coverplate.

3. Provide brass carpet flanges for each floor box installed in carpeted areas.

4. Multiple device locations shall incorporate two (2) or three (3) gang outlet box.

I. Provide GFI receptacles within 6 feet of any sink, lavatory, wet area and outdoors. All GFI resets to be located in the same room protected.

J. Provide GFI protection for all receptacles in areas where power hand tools or portable lights are used (shop areas, garages, etc.).

K. Provide GFI protection for all circuits used for heat tracing.

L. Provide a receptacle in all mechanical/electrical rooms.

M. Surge Arresting Receptacles: Where surge arresting receptacles are indicated, provide receptacles meeting Federal Specification WC-596F which are UL listed (UL 1449 and UL 498) with integral surge suppression. Provide with audible surge protection failure alarm and replaceable surge arrester module. Eagle Electric “Super Spec SurgeBloc” or acceptable equal.

N. All 120volt/20amp receptacles in kitchen area to be GFCI protected.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wiring devices of the type as indicated on drawings. Make up all connections tight and set device plumb. Use care in installing device in order to prevent damage to the device and the wire in the outlet box.

B. Device Plates: Provide a device plate for each outlet to suit the device installed and install blank plates or covers for junction boxes and empty outlets, including telephone, computer, etc.

C. Mount duplex receptacles vertically with grounding opening up unless otherwise noted.

D. Prior to installation of outlets other than 20A, 120 Volts, verify receptacle type with Owner through Architect. Receptacles not verified shall be changed at Electrical Contractor’s expense if necessary, to operate equipment.

E. Install all switches that are required to be handicap accessible at proper height per latest ADA Standards.

F. Install wall switches vertically in an outlet box on the strike side of the door as finally hung.

G. Install single throw switches so up is the ON position.

H. Locking switches shall be furnished in corridors, common areas and any area with HID lighting. Contractor shall confirm exact location of all locking switches with the Architect/Engineer prior to rough-in.

I. Provide “Caddy Screw Gun Bracket” between wall studs, as required to install switches, thermostats, intercom devices, etc. Verify exact location of devices prior to rough-in. Device boxes shall be aligned on center line of each box.

J. Receptacles installed for electric water coolers shall be mounted at a height so as not to be visible after installation of EWC. Coordinate with equipment being provided.

K. Provide one (1) duplex GFI/weatherproof receptacle within 25 feet of all mechanical equipment, located on the roof, on mezzanines, or on the ground. Connect receptacles to nearest available circuit with not more than 6 receptacles or home run to the nearest available panelboard and provide breaker as required.

L. Engrave coverplates, designated for engraving, with 1/8-inch-high contrasting lettering.

M. Engrave the coverplates of wall switches that control equipment which is not in sight of the switch with the designation of the equipment being controlled. Lettering shall be 1/8-inch-high and of a contrasting color.

N. All receptacles located above counter tops with sinks and receptacles in kitchens shall be GFI Type.

O. **Tamper resistant receptacles must be provided where used in the locations described in NEC 406.12 including, but not limited to:**

1. **Educational facilities**

2. **Hotel/motel guest rooms and common areas**

3. **Assisted living facilities**

4. **Dwelling units/dormitories**

5. **Offices, corridors and waiting areas of clinic/medical office buildings.**

6. **Assembly occupancies as described in NEC 518.2.**

P. **Provide ten (10) additional receptacles in base bid including wire, conduit, breakers and appurtenances. Each receptacle represents a dedicated circuit. Estimate length of circuit is 150 feet. Final location as directed by Architect.**

Q. **Provide six (6) additional lighting control stations including wire and conduit. Estimated length to circuit is 75 feet. Final location is directed by architect.**

R. **Provide six (6) additional motion sensors including wire and conduit. Estimated length to circuit is 75 feet. Final location is directed by architect.**

S. **Provide six (6) additional photocells including wire and conduit. Estimated length to circuit is 75 feet. Final location is directed by architect.**

T. **Provide unit price to add additional receptacles over base bid. Use same lengths indicated above.**

END OF SECTION

SECTION 26 28 15 - SAFETY DISCONNECT SWITCH

PART 1 - GENERAL

1.01 SCOPE OR WORK

A. Provide safety switches for all pieces of equipment per NEC as indicated on the Drawings and specifications or as required.

B. **All safety switches are to be FUSED unless noted otherwise.**

1.02 STANDARDS

A. Conform to U.L. listed and the latest NEMA standards.

1.03 ACCEPTABLE MANUFACTURERS

A. Square D

B. ITE Siemens

C. Cutler Hammer/Westinghouse

D. General Electric

1.04 SUBMITTALS

A. Furnish Engineer shop submittal for safety disconnect switches.

B. Provide shop submittals which include the following information:

1. NEMA type

2. Enclosure type

3. Ampere rating

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. Provide safety switches appropriately rated for use with electrical system 600 Vac for 480 volts, 250 Vac for 208 volts and etc.

B. Provide safety switches NEMA Standard KS1 for type HD (heavy duty), and horsepower rated for A/C motors.

C. Switches requiring fuses and rated 600 amps and below shall be provided with rejection clips. Switches rated larger than 600 amps shall have Class “L” fuse connections provided.

D. Provide safety switches in NEMA 1 enclosure located on the interior dry locations. Provide safety switches in NEMA 3R enclosure located on the exterior of the building or in wet locations.

E. Provide quick-make and quick-break operating handle. Provide mechanisms which are an integral part of the box. Furnish a handle suitable for padlocking in the ON and OFF positions with a padlock of 5/16-inch diameter shank.

F. Door Interlock. Furnish a door interlock to prevent opening the door when the switch is in the ON position, unless bypassed, and to prevent turning the switch ON when the door is open.

G. Bypass Interlock. Furnish an external means to bypass the door interlock.

H. Terminal Shield. Furnish incoming line terminals with an insulated shield so that live parts are not exposed when the door is open.

I. Neutral. Where neutrals are indicated furnish switches with an isolated, fully rated neutral block. Make provisions for bonding the block to switch enclosure.

J. Equipment Grounding. Furnish an equipment grounding kit.

K. Fuse Holders. Where fusible switches are indicated, furnish switches with rejection-type fuse holders and fuses conforming to Section 16490, Fuses - 600 Volt and Below.

L. Auxiliary Contacts. Where switches are shown for elevator service, furnish switches with two DPST auxiliary contacts.

M. Provide lugs U.L. listed for copper cable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely mount safety switches in accordance with the N.E.C. Provide all mounting materials and mount safety switches vertically.

B. In general, safety switches must be mounted on an independent and separate support system, not on the equipment being served. Where such an independent support would require penetrating or resting on a roof, it is preferable to mount on the equipment. In no case, however, may the switch interfere with access to or operation of the equipment, nor shall the switch be located within the significant impact zone of a flue or other high temperature component. Where screen walls are provided for outdoor units; the top of disconnect shall be below or equal to the top of screen wall.

C. Coordinate final location of disconnect switches to provide a minimum of 36” clear in front of switch. Conduit may not be routed in access clear directly in front of disconnect switch.

D. Install switches for all equipment that requires them. Mount so that operating handle is approximately 60 inches above finished floor. Where grouped, align tops of switches.

E. Disconnects mounted above ceiling must be mounted to be readily accessible near unit. Handle to be no more than 36” above ceiling grid.

F. All exterior disconnects to be mounted below line of sight of a screen wall or if single disconnects, level with top of condenser. Verify location with Architect/Engineer prior to rough-in.

END OF SECTION

SECTION 26 28 16 - FUSES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide and install fuses as shown on the Drawings and as hereinafter specified.

1.02 STANDARDS

A. Conform with the latest requirements of the National Electrical Code, NEMA and be UL listed.

1.03 ACCEPTABLE MANUFACTURERS

A. Bussman

B. Gould

C. Little Fuse

PART 2 - PRODUCTS

2.01 MATERIALS

A. Time Delay/Dual Element (Class R) fuses 1/10 through 600 amps.

B. Time Delay/Dual Element (Class RK5) fuses 1/10 through 200 amps for mechanical equipment and where noted.

C. Time Delay (Class L) fuses 601 - 6000 amps.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Fuses shall not be installed until equipment is ready to be energized.

B. Test and inspection shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening and review of all electrical connections and inspection of all grounding conductors.

C. All fuses shall be furnished and installed by the Electrical Contractor.

D. All fuses shall be of the same manufacturer.

E. Equipment Fuses: Verify final fuse size with actual equipment being installed. Do not exceed permitted fuse size and voltage of manufacturer ratings.

3.02 INSTALLATION

A. Mains, Feeders and Branch Circuits:

1. Circuit 0 to 600 amperes shall be protected by current limiting dual-element, time delay fuses. All dual-element fuses shall have separate overload and short-circuit elements. The fuse must hold 500% of rated current for a minimum of ten (10) seconds, with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted). They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

2. Circuits 601 to 6000 amperes shall be protected by current limiting time delay fuses. Fuse link shall be pure silver links (99.9%) pure), to limit the short circuit current let through valves to low levels and comply with NEC Sections requiring component protection. Fuses shall be time-delay and must hold 500% of rated current for a minimum of four (4) seconds with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L. “CAUTION” labels to alert the end user of engineered level of protection of the electrical equipment, shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

3. Motor Circuits - All individual motors rated for 200 horsepower or less shall be protected by time delay/dual-element fuses. The fuses for motors shall be installed in ratings approximately 125% of motor full load current, except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to a full speed quickly, such as large fans. Motors shall be protected by fuses of the rating shown on the Drawings. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted) Dual Element/Time Delay. “CAUTION” labels to alert the end user of the engineered level of protection of the electrical equipment shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

B. Spares:

1. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in cabinet as identified in Specification Section 26 05 00.

END OF SECTION

SECTION 26 28 25 – CONTACTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide lighting contactors as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

A. Approved per UL 508 and designed in accordance with NFPA 1C52-211B.

B. UL listed.

C. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

A. Square D

B. ITE Siemens

C. Cutler Hammer/Westinghouse

D. General Electric

1.04 SUBMITTALS

A. Furnish Engineer shop submittals for contactors.

B. Provide shop submittal which includes the following information:

1. Voltage and ampere rating

2. Wiring diagram

3. Enclosure type

4. Coil voltage

PART 2 - PRODUCTS

2.01 GENERAL

A. Continuously current rated.

B. Capable of making and breaking all cases of loads without the aid of auxiliary arcing contacts. Auxiliary arcing contacts are not acceptable.

C. Industrial duty rated for applications to 600 volts maximum.

2.02 MATERIALS

A. Totally closed, double break, silver to silver power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

B. Provide terminals with straight through wiring and accept copper wire.

C. Provide switches or provisions for switches as indicated on the drawings.

D. Unless otherwise indicated, provide contactor in NEMA Type 1 enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely mount lighting contactor. Provide all mounting hardware.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown. **Fixture performance/lumen output must meet or exceed performance/lumen output specified in the light fixture schedule.**

B. Electrical contractor shall confirm all fixture driver voltage ratings match the project electrical power system lighting circuit voltage prior to submittal and order of fixtures. If fixtures are to be connected to existing lighting circuits, contractor shall field verify the existing circuit voltage prior to submittal and order of site fixtures. Any drivers that need to be replaced after delivery due to incorrect voltage will be at the contractor's expense.

1.02 STANDARD

A. Provide all materials and accessories, whether specifically described or not, of the best grade of the commercial manufacturer. Provide first class workmanship in every respect.

B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures is not acceptable.

C. Manufacture all lighting fixtures in accordance with the National Electrical Code.

1.03 ACCEPTABLE LIGHTING AND LIGHTING CONTROL PACKAGES:

A. Base Bid: Lithonia (Controls – Acuity nLight Series)

B. Base Bid: Others Fixtures as Scheduled or Noted (Controls – Acuity nLight Series)

The following manufacturers shall be quoted as an Alternate Bid:

C. Signify (Controls – Leviton GreenMAX DRC Controls)

D. Hubbell (Controls – Hubbell NX Series)

1.04 SUBMITTALS

A. Furnish Engineer shop drawings for each fixture.

B. Provide shop drawing which includes the following information:

1. Fixture type per the fixture schedule.

2. Manufacturer of the fixture.

3. Physical dimensions of the fixture.

4. Manufacturer's standard finish.

5. Fixture output distribution curves with utilization parameters.

6. Driver temperature rating, voltage, wattage, and manufacturer.

7. Material type and thickness of lens.

8. Accessories for installation such as swivel hangers.

9. Efficacy (lumens/watt).

C. Submit point-by-point lighting calculations for each space type as required by the specifications or noted on the drawings. The calculations shall include Light Loss Factor of 0.9. The calculations shall indicate maintained horizontal footcandle levels at a height of thirty inches above the floor. In interior spaces the maximum point spacing shall be five feet on center; for outdoor applications the maximum point spacing shall be 30 feet on center unless otherwise noted on the drawings.

D. Working samples of all substitutions, if requested: Samples shall be 120 volt with cord and plug attached and shall include specified LEDs and all modifications necessary to meet the requirements specified in the Contract Documents.

E. Lighting Control Submittal

1. Shop Drawing Floorplan drawings at 1/8” scale showing

a. Motion sensor layout as directed on plans

b. Daylight sensor layout as directed on plans

c. Identify enabled fixtures

d. Identify power packs

e. Identify power pack location for open ceiling areas (above panel in electrical room)

2. Symbol legend identifying symbols

3. Control sequences

4. Riser diagrams showing low voltage cabling requirements

5. Cutsheets of all parts

1.05 PRODUCTS STORAGE AND HANDLING

A. Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

1.06 COORDINATION

A. Catalog numbers shown on the light fixture schedule may not include or adequately represent all the options and accessories required herein, this contractor shall conform to these specifications in their entirety.

B. The various ceiling types are indicated on the architectural plans and in the room finish schedules. All lighting fixtures shall be coordinated with the architectural requirements to ensure that the proper trim kit, and/or mounting accessory is provided with each fixture for the intended application. All trim kits and accessories shall be provided by Contractor whether or not they are specifically indicated by the manufacturer's catalog numbers on the lighting fixture schedule.

C. The locations of all lighting fixtures are approximate. Locations are subject to modifications at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide all fixtures as called for in the schedules.

B. Provide manufacturer's standard finish unless otherwise noted.

C. Design all recessed or semi-recessed fixtures compatible with ceilings as installed. Provide frames where required for proper installation.

D. Furnish complete, all fixtures requiring end caps, mounting spacers or other necessary items whether the catalog number shown includes such items or not.

E. Conceal all fixture parts within the fixture construction.

F. **Self-locking lenses/latches are not acceptable.**

G. Lighting fixture construction shall effectively eliminate light leaks between the frame, lens, housing and the interior finish surface. Furnish one lens hold-down clip at two-foot centers.

H. Conceal all fixture parts, including emergency components, within the fixture construction.

I. Fixture construction shall allow parts and lens to be replaced without special tooling.

J. Fixture shall be provided with disconnecting means per current NEC.

2.02 EMERGENCY EXIT LIGHTS

A. Exit lights must conform to the following:

1. Furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.

2. Meet or exceed the current NFPA requirements.

3. Light emitting diode (LED) type.

4. Die-cast aluminum.

5. Concealed and removable directional chevron knock-outs.

6. Stencil face.

7. Red letter color.

B. Label power packs, using a black marking pen, with the identity of the un-switched circuit.

2.03 LED LIGHT FIXTURE

A. Each luminaire shall be designed to operate at an average operating temperature of 25°C.

B. The operating temperature range shall be 0°C to +25°C.

C. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average operating temperature.

D. Power supplies must use Constant Current Reduction (CCR) for dimming.

E. LED lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvin for interior fixtures and 4000 Kelvin for exterior fixtures or as specified on drawings.

F. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.

G. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

H. The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output. The standard operating voltages are 120 VAC, 277 VAC, 347 VAC and 480VAC.

I. Electrical connections between normal power and driver must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation and be replaceable without removing the fixture from the ceiling.

2.04 DRIVERS

A. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

B. Driver shall be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that do not meet these requirements will not be accepted.

C. Electrical characteristics: 120 - 277 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.

D. Dimming: Driver shall be suitable for full-range dimming. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, inaudible in 26db environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.

Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

E. The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output as specified in light fixture schedule with a smooth shut off function to step to 0%.

F. Control Input

1. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers

2. Digital (DALI Low Voltage Controlled) Dimming Drivers

3. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers

G. Driver disconnect shall be provided where required to comply with codes.

H. The electronics/power supply enclosure shall be internal to the SSL luminaire and be accessible per UL requirements.

I. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set luminaries true, free of light leaks, warps, dents or other irregularities. Provide the length of stems as required to hang all luminaries level and in the same plane. **VERIFY THE TYPE OF ALL CEILINGS BEFORE ORDERING FIXTURES AND PROVIDE FIXTURES AND MOUNTINGS TO SUIT**. Mount all fixtures at a position and height to clear equipment, ductwork, piping, etc., in mechanical rooms, storage rooms, etc. Provide appurtenances for all light fixtures, which include stud supports, stems, mounting brackets, frames and plaster rings.

B. Support luminaries only from structural elements which are capable of carrying the total weight. Mount all lighting fixtures rigid with no rocking action. Provide 13/16” channels as needed.

C. The locations of all lighting fixtures as shown are approximate. It is understood that they are subject to such modifications as may be found necessary or desirable at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.

D. Install drivers and fixtures in accordance with the NEC and ANSI Standards.

E. Adjust all floodlights and spotlights to the satisfaction of the Engineer.

F. Connect all exit lighting fixtures to the nearest unswitched circuit or the nearest emergency circuit. Connect all emergency lighting fixtures to same circuit as normal area lighting in same area per NEC Article 700.

G. Provide all exit signs with required directional arrows, to indicate direction of egress travel.

H. **Fixtures shall NOT be daisy chained together.**

I. Troffer (lay-in) lighting fixtures shall be supported from the building structure by a minimum 12 gage galvanized carbon steel soft temper hanger wires. Install two hangers at diagonally opposite corners of each lay-in light fixture 2'x4' or smaller and one hanger at each corner of each lay-in light fixture larger than 2'x4'. Supporting of light fixtures from ceiling system is not acceptable.

J. Each recessed lighting fixture shall be separately connected to a junction box with a flexible wiring method (i.e. daisy chaining from fixture to fixture is not allowed). The flexible conduit from the junction box to the fixture shall not lay on the ceiling as finally installed and shall not exceed 6 feet in length.

K. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.

L. Pendant mounted light fixtures shall be provided with ¾", threaded, rigid metal conduit, painted to match the fixture color.

M. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface, provide gaskets as needed.

N. Install high or low bay light fixtures between the joist with the bottom of the reflector flush with the bottom cord of the joist. Engineer will direct if obstructions such as ducts, beams, etc. are permanently installed below the joist.

O. Locate mechanical, electrical, equipment, etc. room light fixtures to provide the best coverage and clear all obstructions such as ducts, piping, bracing and supports.

P. High Bay lights are to be rigidly mounted with all thread, ¾" threaded rigid metal conduit and unistrut or suspended from aircraft cable as noted on plans.

3.02 CLEAN UP

A. Leave all fixtures in clean condition, free of dirt and defects.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all exterior lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown. Exterior lights shall be circuited through lighting contactor for time clock/photocell control.

B. Electrical contractor shall confirm all site fixture driver voltage ratings match the project electrical power system voltage and site lighting circuit voltage prior to submittal and order of site fixtures. If site fixtures are to be connected to existing site lighting circuits, contractor shall field verify the existing circuit voltage prior to submittal and order of site fixtures. Any drivers that need to be replaced after delivery due to incorrect voltage will be at the contractor's expense.

1.02 STANDARDS

A. Provide all materials and accessories, whether specifically described or not, of the best grade of commercial manufacturer. Provide first class workmanship in every respect.

B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures will not be acceptable.

C. Manufacture lighting fixtures in accordance with the National Electrical Code.

D. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania.

1.03 ACCEPTABLE LIGHTING PACKAGES:

A. Base Bid: Lithonia

B. Base Bid: Others Fixtures as Scheduled or Noted

The following manufacturers shall be quoted as an Alternate Bid:

C. Signify

D. Hubbell

1.04 SUBMITTALS

A. Furnish Engineer shop drawings for each fixture.

B. Provide shop drawing which includes the following information:

1. Fixture type per the fixture schedule

2. Manufacturer of the fixture

3. Physical dimensions of the fixture

4. Manufacturer's standard finish

5. Lamp type recommended by the manufacturer

6. Fixture output distribution curves and photometrics

7. Ballast temperature rating, voltage, wattage, and manufacturer

8. Material type of lens

C. Furnish structural engineer with approved shop drawings on pole, post and Bollard light fixtures for purpose of designing fixture base.

1.05 PRODUCT STORAGE AND HANDLING

A. Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide luminaire complete with the fixture housing, refractor, lamp, and ballast.

B. Provide type, wattage, and voltage lamp designated on Drawings.

C. Where indicated on Drawings, provide parking lot poles and floodlight poles.

2.02 LED LIGHT FIXTURE

A. Each luminaire shall be designed to operate at an average operating temperature of 25°C.

B. The operating temperature range shall be 0°C to +25°C.

C. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average operating temperature.

D. Power supplies must use Constant Current Reduction (CCR) for dimming where dimming is specified.

E. LED lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 4000 Kelvin for exterior fixtures or as specified on drawings.

F. Lumen output shall not decrease by more than 30% over the minimum operational life of 60,000 hours.

G. Individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

H. The luminaire shall operate from a 50 or 60 Hz ±3 Hz AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output. The standard operating voltages are 120 VAC, 277 VAC, 347 VAC and 480VAC.

I. Electrical connections between normal power and driver must be modular utilizing a snap fit connector. All electrical components must be easily accessible after installation and be replaceable.

2.03 DRIVERS

A. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.

B. Driver shall be UL Recognized under the component program and shall be modular for simple field replacement. Drivers that do not meet these requirements will not be accepted.

C. Electrical characteristics: 120 - 277 volt, UL Listed, CSA Certified, Sound Rated A+. Driver shall be > 80% efficient at full load across all input voltages. Input wires shall be 18AWG solid copper minimum.

D. Dimming (where specified): Driver shall be suitable for full-range dimming. LED dimming shall be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, inaudible in 26db environment, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.

E. The luminaire shall be capable of continuous dimming (when specified) without perceivable flicker over a range of 100 – 10%, 100 – 1.0% or 100 – 0.1% of rated lumen output as specified in light fixture schedule with a smooth shut off function to step to 0%.

F. Control Input (when dimming is specified)

1. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers

2. Digital (DALI Low Voltage Controlled) Dimming Drivers

3. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers

G. Driver disconnect shall be provided where required to comply with codes.

H. The electronics/power supply enclosure shall be internal to the SSL luminaire and be accessible per UL requirements.

I. The surge protection which resides within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 2002 for Location Category A, where failure does not mean a momentary loss of light during the transient event.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Orient lighting fixtures as shown on Drawings.

B. Wall mounted fixtures shall be mounted flush to the building wall and mounted level in all axes. Where fixtures are mounted to metal panel, the contractor shall provide all materials required for a solid structural mounting surface inside the metal panel for securing the weight of the fixture and provide all necessary trim and flashing to have a flush mounted finished appearance with sealed penetrations. Fixtures mounted directly to metal panel that do not meet the description above will be rejected. All modifications required to suit the description above will be performed at the contractor's expense.

C. Adjust all floodlights and spotlights to the satisfaction of the Engineer.

D. Coordinate exact location of lighting fixtures with Architect prior to rough-in.

3.02 CLEAN UP

A. Leave all fixtures and poles in clean condition, free of dirt and defects.

END OF SECTION

SECTION 26 99 95 – COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 COMMISSIONING AGENCY

A. The Commissioning Agency (CA) has been contracted directly with the owner for this project.

B. The CA has overall responsibility for planning and coordinating the HVAC commissioning process. However commissioning involves all parties to the design and construction process, including the electrical (Division 26) contractor, as many HVAC system components require electrical power and controls in order to operate as specified.

1.02 CONTRACTOR RESPONSIBILITY

A. The electrical (Division 26) contractor shall be available as needed to confirm items and perform function test pertinent to commissioning when specified as part of the job.

B. Lighting Controls

1. Interior and Exterior

C. Provide Start-up Report

1. Lighting Controls

2. Surge Protective Devices

3. Transformers.

D. Generators and Transfer Switch

1. Provide all things required to provide functional test of entire Generator and ATS system.

E. Power Feeders, Megger Reading and Lighting Protection

1. Provide copies of forms required in electrical specifications.

2. For any areas of concern, provide additional test as needed to confirm performance.

END OF SECTION

SECTION 28 46 00 – FIRE ALARM & DETECTION SYSTEM

PART 1-GENERAL

1.01 SCOPE OF WORK

A. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

B. SYSTEM DESCRIPTION: The Contractor shall provide all equipment, materials, tools, labor, engineering, drawings, testing, and certifications necessary for a complete operational, code compliant, addressable/voice evacuation fire alarm system for the entire building. The purpose of the contract documents is to convey to the Contractor the scope of work required, for which the Contractor is responsible to furnish, install, adjust and make ready for operation.

1. In remodel areas, contractor may reuse existing conduit and boxes if in correct locations, and if they are compatible with new devices, otherwise provide new.

2. Coordinate timing of system replacement with Owner.

C. SPECIAL NOTE:
Cad Drawings:
Architectural Background Files – **Architectural Files are background files; MEP drawings are not background files.** To insure the most current Architectural files are used for shop drawings backgrounds, they must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

Contract Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades.

MEP Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested, they may be obtained for $200.00 per file and a signed confidentiality release form. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. See submittal and shop drawing section for additional information.

D. All major elements of the work are described. The Contractor is expected, to anticipate and include in the cost of the work any incidentals that may be required, but are not specifically expressed, in order to provide a complete and fully functional fire alarm system for this structure.

E. This is a performance specification. Specifications and drawings reflect the intent and scope of the project. The Contractor is expected to make allowances for necessary adjustment during the actual system installation, to examine physical conditions, coordinate the actual device locations as necessary to accommodate the existing

conditions, obstructions, manufacturer's installation specifications, applicable codes, and the work of others. No extra payments will be allowed for the Contractor on account of extra work made necessary by his failure to make such allowances. The cost associated with this task shall be included in the Contractor's base bid. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner for clarification prior to submission of the base proposal price. **CONSTRUCTION AND INSTALLATION DRAWINGS SHALL BE PREPARED BY A STATE OF TEXAS LICENSED ALARM DESIGNER, NICET 111 OR PE (REGISTERED PROFESSIONAL ENGINEER) IN THE STATE OF TEXAS. FIRE ALARM CONTRACTOR TO BE ACR CERTIFIED.**

1. The Installing Contractor shall be licensed by the Texas Commission on Fire Protection to sell, install and service Elevator Recall Systems as required by Article 5.43-2 of the Texas Insurance Code. Reference Elevator Recall Specification.

F. Drawings reflect general location of devices and may not include all devices.

G. **Contractor to provide all devices required by code and local authorities and should appear on Fire Alarm Shop drawings.** The Contractor shall provide all devices and equipment as required by these specifications. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the architect, engineer, and owner's representative. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the contractor.

H. Voice Evacuation: The Fire Alarm Contractor shall provide ADS (Acoustically Distinguishable Space) drawings with fire alarm shop drawings to show proper performance of intelligibility throughout the campus. They are to be approved, along with the shop drawings, by the Fire Marshal.

I. **Fire Alarm Contractor to obtain system approval from Local Fire Marshall. System Planner's Name and License Number are to appear on shop drawings.**

J. **Duct detectors on air handlers must be connected to the alarm panel, and the location of the detector must be clearly indicated at the fire alarm panel.**

K. **Electrical Contractor is to coordinate location of back boxes for exterior devices prior to exterior walls being erected, to insure flush mount devices are installed where specified.**

L. **For standard rough-in locations of A/V or Visual Devices in most rooms including classrooms reference Detail "Typical Device Location Next to Doors".**

M. **Reference Mechanical Unit Schedule for additional duct detector requirements and quantity of gas fired Mechanical Equipment which requires Carbon Monoxide (CO) detection.**

1.02 PERFORMANCE GUIDELINES

A. This Contractor shall provide labor, materials, equipment, and installation for a functional fire alarm and as outlined in these specifications and shown on the drawings. The Contractor shall be responsible for compliance with the entire project specifications as well as the following guidelines. The guidelines are not intended to be all-inclusive, to limit or define the Contractor's Scope of Work. The work includes the following:

1. Installation of a complete operational point addressable fire alarm system.

2. Core drilling and fire stopping.

3. Cutting, patching and fire caulking. (Keep UL details at site for fire caulk being used.)

4. Detailed shop drawings.

5. Coordinate the work with other trades for this project and coordinate with any other Owner projects in the building ongoing at the time of Fire Alarm Contractor's work.

6. Provide on-site project supervision by a person licensed by the State Fire Marshal while any installation is being performed.

7. Develop a construction schedule, conduct bimonthly job progress meetings, and issue bimonthly written job progress reports to the Owner and Engineer.

8. Provide record documents as required by code, AHJ and specifications.

9. Provide operating and maintenance instructions.

10. Conduct a test of the system upon completion of installation to assure the Contractor and the Owner that the system is operational. This test shall take place prior to the commissioning test.

11. Conduct the commissioning test. The Fire Alarm Contractor shall furnish personnel who are familiar with the installation at a time convenient to the Authority Having Jurisdiction, Owner and Engineer.

12. Provide training of Owner's personnel.

13. Provide design and as built drawings in ACAD *2000* or later DWG format.

14. Provide 1-year job site warranty of all materials and labor furnished under this section. The 1-year warranty shall begin upon Authority Having Jurisdiction, Owner and Engineer acceptance.

15. Provide final approved printed set of fire alarm drawing in main electric room. Put in 4" PVC labeled tube and secure to wall.

B. **Devices required but not limited to the following areas:**

1. Visual devices in all rooms except single offices, janitor's room and small mechanical rooms.

2. Option 1 - Pull stations at every door to exterior of building and additional pull stations shall be provided so that the travel distance to the nearest fire alarm pull station will not be in excess of 200 feet measured horizontally on the same floor as required by code. Provide Stopper ll covers on all pull stations.

3. Option 2 - Provide pull stations as required by code, including but not limited to the following locations: at FACP, fire riser room, cafeteria exits to exterior, main school exit to exterior, gym exits to exterior, library exits to exterior. Review final locations with Owner prior to AHJ review.

4. Audio/Visual devices in all common area toilet rooms and visual device in single fixture restroom.

5. Install Audio/Visuals (Speaker/Strobes) in corridors spaced to be clearly audible above ambient noise (Maximum 100' o.c. and not more than 15' from the end of a corridor) and as required by local Fire Marshal or authority having jurisdiction.

6. Connect tamper/flow switches for the sprinkler system. Switches provided by Sprinkler Contractor. Coordinate with Sprinkler Contractor for compatibility.

7. Provide twenty percent (20%) excess capacity in the fire alarm panel and on each circuit to allow for future expansion by the owner.

8. Provide rough-in junction boxes for all devices and conduit to above ceiling or accessible area.

9. Smoke detectors in all storerooms, Technology/Data rooms, and any room housing power supplies.

10. Heat detector in all electric and Technology/Data rooms.

11. Provide magnet hold opens and door releases for all fire doors and coiling doors. Reference architectural door schedule and hardware specification for quantity, location and type. Make all required connections.

12. Install smoke or heat detectors at each elevator landing per code and authority having jurisdiction.

13. Install ceiling mounted heat and smoke detectors in Elevator Machine Room.

14. Install exterior device as required by code and plans.

15. Provide duct smoke detectors in the following areas as required by code and the Local Authority Having Jurisdiction. Install duct smoke detectors in supply and return air of all units OVER 2000 CFM, all units grouped together with common return and combined CFM OVER 2000, all units serving rated egress ways. **REFERENCE MECHANICAL DRAWINGS AND/OR MECHANICAL SCHEDULES FOR ADDITIONAL INFORMATION.** Detectors to be provided by Fire Alarm Contractor, installed by Mechanical Contractor, with final connection by Fire Alarm Contractor. Duct smoke detectors shall be installed inside air mover device where possible. Refer to Mechanical Equipment Schedule for additional information on units. Fire Alarm Contractor to provide, set and connect to relay with shut down contacts inside air mover device control panel, if space prohibits installation of relay inside air mover device control panel, then install relay in an enclosure (Nema 1 or Nema 3R as required) mounted on air mover device. Electrical Contractor shall provide and install control wiring from relay to air mover device controls cabinet. Coil wire in controls cabinet for Mechanical Contractor to make final connection to air mover unit controls. At Fire Alarm Contractor's option, FULL AREA DETECTION may be used in lieu of duct

detectors. Provide smoke detectors in any existing units as required, field verify locations.

16. Audio/Visual (Speaker/Strobes) devices in all classrooms and time out rooms as required.

17. Install ceiling mounted smoke detectors, maximum of 30 feet on center and 15 feet from the end, in all egress corridors.

18. Provide visual device directly outside fire sprinkler room.

19. Install wall-mounted speakers in corridors at spacing required for intelligibility.

20. Provide ceiling mounted carbon monoxide (CO) detection in all classrooms served by gas appliances and all mechanical rooms with gas appliances per latest IFC, section 915 and NFPA 720 (rated for commercial). Detector to report locally and back to main fire alarm panel to monitoring station. Must have own zone. Base Bid to provide CO detection in ALL classrooms, libraries, gym, stage, cafeteria, and kitchen. CO detection for large areas to be multiple devices based on coverage of device used. Can only be removed by Local AHJ approval at shop drawing phase. Provide credit at that time if allowed.

21. Provide connection to HVLS fan controllers for shutdown upon fire alarm activation.

C. Coordinate final location of fire alarm panel with Owner and Engineer.

D. Fire Alarm Contractor responsible for all rough-in and providing power for fire alarm panel and power supplies.

1.03 APPLICABLE STANDARDS

A. The following standards and guides (current adopted edition) are hereby made a part of this work by reference there to.

B. National Fire Protection Association (NFPA):

1. NFPA 13 - Installation of Sprinkler Systems,

2. NFPA 20 - Installation of Centrifugal Fire Pumps,

3. NFPA 70 - National Electrical Code,

4. NFPA 72 - National Fire Alarm Code,

5. NFPA 90A - Standard for the Installation of Air-conditioning and Ventilating Systems

6. NFPA 92A - Recommended Practice for Smoke Control Systems

7. NFPA 92B - Guide for Smoke Management Systems in Malls, Atria, and Large Areas

8. NFPA 101 - Life Safety Code

9. NFPA 110 - Emergency and Standby Power Systems

10. NFPA 1221 - Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

C. Underwriters Laboratories latest edition:

1. UL Standard 346, Waterflow Indicators for Fire Protective Signaling Systems

2. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems

3. UL Standard 521, Heat Detectors for Fire Protective Signaling Systems

4. UL Standard 827, Central Stations for Watchman, Fire Alarm and Supervisory Services

5. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems

6. UL Standard 864, Control Units for Fire Protective Signaling Systems

7. UL Standard 1424, Cables for Power-Limited Fire Protective Signaling Systems

8. UL Standard 1480, Speakers for Fire Protective Signaling Systems

9. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems

10. UL Standard 1971, Signaling Devices for the Hearing Impaired

11. UL Standard 1711, Amplifiers for Fire Protective Signaling Systems

12. UL Standard 2524, Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems

D. American National Standards Institute (ANSI) A17, Safety Code for Elevators and Escalators, latest edition.

E. Americans with Disabilities Act Accessibility Guidelines (ADAAG) latest edition.

F. Texas Accessibility Standards (TAS), latest approved edition.

G. International Fire Code (IFC) current edition.

H. International Building Codes (IBC)

I. IEC 60268-16:2011(E) Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index.

J. ISO 7240-24:2010 Fire detection and fire alarm systems – Part 24: Sound system loudspeakers.

K. ANSI 117.1 American National Standard for Accessible and Useable Buildings and Facilities.

L. FCC Title 47 Part 90, Safety and Special Radio Services - Private Land Mobile Radio Services

M. FCC Title 47 Part 15b, Safety and Special Radio Services – Radio Frequency Devices

N. All requirements of the local Authority Having Jurisdiction (AHJ).

1.04 DEFINITIONS AND ABBREVIATIONS

A. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Owner and Engineer.

B. Authority Having Jurisdiction: Local Fire Department having jurisdiction
Texas Department of Insurance State Fire Marshal's Office

C. Concealed: Where used in connection with installation of piping or conduit and accessories, shall mean, "hidden from sight" as in shafts, furred spaces, in soffits, in walls or above suspended ceilings.

D. Contractor: The company awarded the prime contract for this work and any of it's subcontractors, vendors, suppliers or fabricators.

E. Exposed: Where used in connection with installation of conduit and accessories shall mean "visible" or "not concealed".

F. Acoustically Distinguishable Space (ADS): An area distinguished, enclosed, or physically defined from other spaces due to acoustical, environmental, or use characteristics, such as reverberation time and ambient sound pressure level. A basic area of a building or a single room identified for individual measuring of intelligibility.

G. Common Intelligibility Scale (CIS): A system created to map all quantitative intelligibility measurement methods to the same scale so that all different results can be compared.

H. Speech Transmission Index (STI): A scale and quantitative methodology for measuring the intelligibility of a communication system using a test signal audible program of wide band modulating frequency tones, which encompass a combination of vowels and syllables simulating common speech. While the test signal is being played through the communication system, the test instrument computes the signal to noise ratio based on the impact of background noise, reverberation, and distortion. During the test runtime, a value is calculated, and the result displayed on the test instrument screen which will be between zero and one on the STI scale, representing the weighted average estimate of system intelligibility at that location.

I. Voice Intelligibility or Speech Intelligibility: The quality or condition of being intelligible, capable of being understood; comprehensible; clear, precise and audible. Voice intelligibility test results for an emergency communication system are considered acceptable if at least 90% of the measurement locations within each ADS have a measured STI of not less than 0.45 (CIS of not less than 0.65), and an average STI of not less than 0.50 (an average CIS of not less than 0.70).

J. Delivered Audio Quality (DAQ): A measure of speech intelligibility of land mobile radios.

1.05 RELATED WORK

A. Related work existing or specified in other sections:

1. Electrical

B. Existing equipment or equipment furnished and installed by others under another section of the specification to be wired, and connected to the fire alarm system by the fire alarm contractor as required:

1. Fire Smoke dampers are furnished and installed *by* others. The Fire alarm contractor to provide an alarm relay (contacts rated minimum 10 amp) for control.

2. AHU, RTU, HVLS Fan (equipment) shutdown control. Fire alarm Contractor to provide an accessible control relay for equipment control. Fire alarm contractor to provide necessary wire conductors from control relay to equipment connection point. Fire Alarm contractor to provide and install duct smoke detectors.

3. Provide electrical power connections to all fire alarm panels.

4. SPECIAL SYSTEM: Fire suppression system alarm micro-switch provided by others, to be wired and monitored by the fire alarm contractor.

1.06 PERFORMANCE REQUIREMENTS

A. Install a UL listed point addressable fire alarm and supervisory alarm system. Acceptable manufacturers are listed in the Part II - Products section. The new system shall include but, is not limited to, the following as required:

1. Provide devices to properly monitor and supervise the sprinkler system devices. This includes all waterflow devices, all valve supervisory devices, and all devices associated with the fire pump to be installed by the Sprinkler Contractor.

2. Where voice evacuation is required provide shut down of amplified sound system upon alarm.

3. Provide user controls *for* override of smoke control/fan shutdown functions to allow for maintenance and testing to minimize disruption of normal activities, i.e. walk test or service group functions.

4. All initiating devices shall have a unique digital address. Monitor devices for water-based fire extinguishing system valve position supervisory switches shall be allowed to have a maximum of five (5) supervisory switches per address provided the valves are located in the same physical area.

5. Where indicated on bid documents the audible portion of the public alarm shall be a voice evacuation system. Signals generated shall be the distinctive evacuation signal with a digitized textual message. It shall allow for voice paging to selected areas and an all-call control.

6. All system must be listed and approved as a smoke detector sensitivity test set and be capable of providing drift compensation.

7. All systems must be field programmable for all changes, alterations, modifications, additions, deletions and hardware and software upgrades.

8. All systems must be capable of generating comprehensive reports for sensitivity, verification counts and address registers.

B. Systems Circuit Wiring:

1. All fire alarm initiating device circuits (IDC) shall be NFPA 72, Style B, electrically supervised circuits from the point addressable interface modules to the devices.

2. All fire alarm point addressable circuits (SLC) shall be NFPA 72, Style 6, supervised signaling line circuits from the fire alarm panel to the point addressable sensors or point addressable interface modules.

3. All notification appliance circuits (NAC) shall be NFPA, Style Y, supervise notification appliance circuits from the fire alarm panel to the audible devices, and strobes.

1.07 SYSTEM OPERATION

A. The point addressable fire alarm and supervisory system shall perform the following functions:

1. Continuous monitoring of the status of all-new alarm and supervisory signal initiating devices.

2. Continuous monitoring of all new electrically supervised initiating, supervisory, and signaling circuits.

3. Visible point annunciation of all fire alarm point trouble conditions at the control panel.

4. Operation of elevator controls as indicated herein.

5. Be silenced by a code or Firefighter key at the main or remote annunciators

B. Upon change in status of any device on the system, the fire alarm control panel shall activate audible and visible status change indicators and display the system point number, point description and message associated with the point. Permanently record the change in status, time, date, point description, and message in the history buffer, and transmit the point ID information to the central monitoring station.

C. Activation of any smoke detector, heat detector, manual pull station, supervisory device or other initiating device will cause the following functions to occur:

1. Duct type smoke detector operation shall cause the following to occur:

a. Activate audible and visible status changes indicators and display the system point number, point description, and message associated with the point on the system’s operator terminal.

b. Permanently record the change in status, time, date, point description, and message associated with the point in history buffer

c. Release electronically held open and or locked doors.

d. Activate smoke control system.

e. Activate the supervisory signal

f. Transmit supervisory condition using point ID to the Owners Central Station, point description, and message associated with the point on the system's operator terminal.

g. Permanently record the change in status, time, date, point description, and message associated with the point in history buffer

h. Activate the audio/visual alarm

2. Supervisory device or trouble condition activation, including valve supervisory devices, shall: Activate audible and visible status with the point on the system's operator terminal.

a. Permanently record the change in status changes indicators and display the system point number, point description, and message associated, time, date, point description, and message associated with the point in history buffer

b. Transmit supervisory condition using point ID to the Owners Central Station

c. When the device in trouble is restored to normal, the control panel shall be automatically reset

D. Activation of an auxiliary bypass switch for Elevator Recall System shall override the automatic functions either selectively or throughout the system and initiate a trouble condition at the control panel.

1.08 SUBMITTALS

A. Submit the following equipment information:

1. Manufacturer's data sheets with equipment to be used highlighted

2. Wiring diagrams of all equipment,

3. Installation instructions for all equipment,

4. Equipment dimensions,

5. Equipment testing procedures,

6. Equipment operation and maintenance manuals,

7. Wire data sheets.

B. Submit the following software information:

1. Complete sequence of operation with input/output matrix for all points

C. Submit the following system calculations:

1. Standby battery capacity for fire alarm
2. Standby battery capacity for voice alarm
3. Standby battery capacity for all remote panels
4. Voltage drop calculations for each type of circuit (identifying all mathematical formulas, variables, constants, and sources of the mathematical constants),
5. Speaker zone/circuit loading (including amplifier loading),
6. Strobe zone/circuit loading,
7. Normal 120 VAC fire alarm panel(s) circuit loading,
8. Normal 120 VAC voice alarm panel(s) circuit loading,
9. Normal 120 VAC remote panel circuit loading.

D. Provide the following shop drawing information (Shop drawings shall be prepared using AutoCAD. Shop drawings shall be drawn to scale: 1/8” = 1’0” for floor plans

1. Complete point to point wiring diagrams showing all field terminations.
2. Complete panel layout showing location of all modules, power supplies, batteries, and all field terminations.
3. Complete system riser diagrams, indicating wire sizes and types,
4. Interaction with all other building systems (i.e. elevator, AHU, FSD)
5. Complete floor plans showing all devices with point numbers
6. Main panel elevations
7. ADS drawings.
8. Backgrounds for floor plans to be obtained from Architect not MEP Engineer. Reference Specification Section, “26 05 00 - General, 1.01, L”.

E. Submittal packages shall be signed by NICET III or signed and sealed by a PE registered in the State of Texas.

F. Prior to start of construction, submit the information outlined in A, B, C, and D above as follows:

1. Three complete system packages to the Owner for review by the Owner and Engineer.

2. One copy of Authority Having Jurisdiction (AHJ) “Approved Plan”

1.09 PARTIAL SUBMITTALS ARE NOT ACCEPTABLE.

1.10 WARRANTY

A. This Contractor shall provide a one-year written warranty against defects in material and workmanship furnished under this Contract. The costs of such warranty shall be part of the purchase price. The warranty shall commence when the Owner and Engineer accept the system and installation.

B. The warranty shall include all necessary material, travel, labor and parts to replace defective components or materials at the job site. This Contractor shall commence repair of any “in warranty” defects within 8 hours of notification of such defects.

C. The Contractor shall include, as part of the one-year warranty, a test and inspection of the new fire alarm devices within one month prior to the expiration of the one-year construction warranty. The Contractor shall provide a written report of any deficiencies and repair any of the deficiencies. The test and inspection report shall conform to the test and inspection form as described in NFPA 72 and as required by the AHJ.

1.11 UNIT PRICES

A. The Contractor shall provide with his bid, unit price during construction for the items in the following list. The unit prices for the devices shall include the device, installation, 20 feet of conduit, wire, programming and any other required installation.

1. Addressable rate of rise heat detector.

2. Addressable photoelectric smoke detector.

3. Beam smoke detector.

4. Addressable duct smoke detector with relay.

5. Addressable manual pull station.

6. Point addressable monitor module.

7. Point addressable control/relay module.

8. 24 VDC Relay SP/DT, with 10 amp rated contacts

9. Fire Alarm Speaker.

10. Strobe Wall Mount. 15/75, 30, 75, and 110 candela rating

11. Strobe Ceiling Mount. 15/75, 30, 75, and 110 candela rating

12. Speaker/Strobe Wall Mount. 15/75, 30, 75, and 110 candela rating

13. Speaker/Strobe Ceiling Mount. 15/75, 30, 75, and 110 candela rating

14. Horn/Strobe Wall Mount15/75, 30, 75, and 110 candela rating

15. Horn/Strobe Ceiling Mount 15/75, 30, 75, and 110 candela rating

16. Remote 80-character LCD annunciator

17. Distributed power module

18. Intelligent power module

19. Stopper II manual pull station cover

20. Carbon Monoxide (CO) detector

1.12 QUALITY ASSURANCE

A. The fire alarm system manufacturer or authorized distributor shall maintain a fully staffed branch office including application engineers, drafters and technical service personnel.

B. All supplied equipment shall be new, currently manufactured, standard product of the manufacturer.

C. All technical service personnel shall be regularly employed by the distributor of the fire alarm system.

D. The installing Contractor shall hold a current license, issued by the State of Texas Commission on Fire Safety, to design, install, and service fire detection and alarm equipment.

E. All electrical installation of the fire alarm system, including wire installation and terminations, shall be performed by personnel employed by the Fire Alarm Contractor.

F. Any subcontractors used to install portions of the system shall be submitted and approved by the Owner and the Engineer prior to commencement of the installation.

1.13 SUBSTANTIAL COMPLETION

A. Substantial completion shall be the date of AHJ inspection.

PART 2 - PRODUCTS

2.01 MAIN FIRE ALARM PARTS INFORMATION (Make sure this is 2.00, A-E stays on ONE page)

A. Manufacturers:

1. Basebid shall be Silent Knight/Farenhyt (with Emergency Communication System)

B. Control Panel

1. Silent Knight IFP-2100ECS or 6820EVS analog addressable control panel with Emergency Communication Systems.

2. Where voice evacuation is required, Contractor shall provide emergency communications at both the FACP and RVEP locations.

3. Provide LTE/IP Dual Path Fire Communicator – Honeywell ‘HWF2A-COM’ or equal as approved by local AHJ.

C. Fire Alarm System Devices

1. Analog Photoelectric Smoke detector
2. Analog Heat Sensor (with Relay)
3. Addressable Relay Module
4. Duct Detector Enclosure
5. Addressable Input Module
6. Mini Input Module
7. Addressable Relay Module
8. Addressable Notification Module
9. Two Wire Smoke Detector Module
10. Detector Isolation Base
11. Detector Relay Base
12. Detector Sounder Base
13. Duct Detector Housing
14. Remote Test Switch For Duct Housing
15. Addressable Pull Station (with Stopper ll cover or equal)
16. Beam type Smoke Detector (Fire Ray)
17. Document Box (SRD) confirm location.
18. Voice Evacuation Speaker/Speaker Strobes
19. Carbon Monoxide (CO) detector with sounder base (B2005) powered by UL listed power supplies.

D. Remote Transponder Panels

1. Power Module - #RPS-1000 or 5895XL

E. ADA Emergency Call System

1. ADA 100

F. Approved Installers:

1. JM Electronics
2. Care Specialties
3. Firetrol Protection Systems
4. Skelton Timing Control
5. Vanguard Fire & Security
6. Other approved equals

2.02 MAIN FIRE ALARM PRODUCT DESCRIPTION

A. Manufacturers:

1. Reference 2.00 above.

B. Control Panel

1. The fire alarm control panel (FACP) shall be an intelligent addressable control panel with integrated in-building Emergency Voice Evacuation. The FACP must supervise low battery, loss off AC and loss of communication. The communication protocol on the SLC loop must be digital. Reference 2.00 above.
2. The panel must have a built in 80-character LCD annunciator with the capability of having an additional eight supervised remote annunciators connected in the field.
3. The FACP must have a built in UL approved digital communicator. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.
4. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.
5. Devices supported must include analog photoelectric, ionization smoke detectors, analog heat detectors, addressable input modules, relay output modules or addressable notification modules. There is to be no limit to the number of any particular device type up to the maximum of 127 that can be connected to the SLC. Devices must be same manufacturer as control panel. Reference 2.00 above.

C. Normal operating power for the FACP shall be 120-volt AC supplied from dedicated circuits. All circuits shall be protected by circuit breakers of proper size.

D. The fire alarm system shall be provided with an emergency standby power system consisting of backup batteries. Batteries shall be sealed lead-acid or gel cell of sufficient capacity to provide 24 hours standby operation plus 15 minutes in full alarm condition. All calculations shall allow a minimum of 20% safety factor for battery degradation.

E. The FACP shall accommodate all specified initiating device, notification appliance and command points. Each initiating circuit shall allow a 25 percent expansion of connected detection devices and 20 percent expansion of connected monitor/control points. Each notification/signaling line circuit shall allow a 20 percent expansion of connected devices.

F. The Fire Alarm Control Panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is below or above normal limits, the controller shall differentiate between long term drift above the pre-alarm threshold (maintenance alert, indicative of the need for cleaning) and a fast rise above the pre-alarm threshold (indicative of a smoldering fire).

G. The Fire Alarm Control Panel CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

H. Each addressable device on an SLC loop shall systematically report for type identification. Loss of signal from any addressable device shall result in trouble condition indication at the control panel. If the inadvertent installation of another type sensor takes place, the system and the installed device shall operate however, a "WRONG DEVICE" trouble condition will display until the proper unit is installed or the programmed sensor type is changed.

I. The system shall be capable of on-site programming to facilitate changes in operation, sensor sensitivity, or system expansion. The unit shall contain non-volatile EPROM memory; loss of primary and secondary power shall not result in loss of programming information.

J. All system software and firmware shall be UL listed with the control panel and protected from unauthorized changes. The microprocessor shall contain and execute on site programmable logical statements for each control-by-event specific action to be taken when an alarm condition is detected at specific programmed points by the system. Control-by-event equations shall be held in non-volatile programmable memory and shall not be lost even if system primary and secondary power failure occurs. Any software or firmware changes made shall require a minimum of a 10% functional test of the system.

K. The digital communicator shall have the basic capability to transmit the status of the following software zones:

Waterflow Fire Alarm (when applicable)
General Fire Alarm
Point Annunciating Alarm by Zone
Supervisory Alarm
Trouble Condition
Onboard Duct

L. In addition, the digital alarm communicator shall transmit signals indicating: Panel Off-Normal, Signal Trouble, Low Battery, AC Power Failure, and software zone/point identification information for each addressable device that generates an alarm or trouble.

M. The emergency voice/alarm system shall provide high-intelligibility voice signal amplification to drive 25 or 70 VRMS speakers as required. Frequency response of amplifier shall be 400-4000 Hz. Provide as indicated a panel mounted, low impedance, dynamic, push-to-talk microphone. The system shall broadcast a digitally recorded message up to four minutes in length on alarm. The message shall automatically repeat, play alarm tones, and repeat as long as the FACP is in alarm unless the message is overridden by keying message, unless otherwise instructed the message shall be; One round or code-3 temporal horn followed by “Attention, Attention, a fire emergency has been reported. Please leave the building using the nearest exit” or an equivalent standard statement.

N. The amplifier, signal generator, power supply, output transformer, and speaker lines shall be continuously supervised. The FACP shall supervise the activation circuit. Provide circuit overload, overheat, over-voltage, polarity reverse, open/short, and automatic current limiting protection. Provide sufficient battery backup power capacity, from the FACP or a signal power expander, for operation without AC power for twenty-four hours of normal supervision and two hours of emergency operation at the end of the period. Fifteen minutes of evacuation alarm operation at maximum connected load shall be considered the equivalent of two hours of emergency operation; include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries. The power supply/charger and batteries shall supply power limited operating and emergency power. The charger shall be capable of maintaining batteries in a fully charged state without damage and of bringing batteries from a fully discharge to a fully charged state within 48 hours of normal operation.

O. The emergency voice/alarm panel shall be housed in a UL listed cabinet suitable for flush mounting. The door shall provide a key lock to access system microphone, key alike to the FACP. Operator instructions shall be clearly visible inside of cabinet. All internal components shall be enclosed (ie. dead front panel). All components shall be securely mounted, and all cable routed, and tie wrapped in a neat, professional manner. All equipment provided shall be UL listed for fire protective signaling.

P. The system shall be a multi-purpose NFPA compliant, supervised, general purpose audio, and fire/emergency evacuation system. Approvals for the system shall include: UL 864, UL 1711, FCC Part 15, CE, CSFM, and MEA. The system shall be OSHA 1910.165 and ADA compliant.

Q. The system shall include a voice evacuation system incorporating supervision during the broadcasting of background music and general paging.

R. Standard on-board system features shall include digital voice messaging, a hand-held push-to-talk microphone with override priority, and a power supply/battery charger. The system shall be capable of interfacing with telephone systems for general paging announcements and will have night ringer capabilities. Form C contacts shall be provided for system alarm and trouble conditions. The system shall have an internal sounder to indicate trouble and shall be capable of being silenced using a trouble acknowledge switch.

S. The system shall have three fire alarm notification appliance circuit inputs with a voltage range of 9 to 31 VDC. The system shall have eight priority ordered inputs, including: On Board Microphone, Auxiliary Input (Line Level), three Digital Messages, Telephone Paging Input, Night Ringer Input and Background Music Input. The system shall have preset audio levels for emergency messaging (prerecorded and live microphone). The system shall revert to a preset level regardless of the volume set for background music (BGM) or general paging. Background music inputs can be an AM/FM tuner, cassette, CD, or any other remote source. The system shall be supplied with customer unique messages. The system shall have a dual-tone tone generator with Code-3 Tone and Slow Whoop. When the system is on battery power, telephone page, night ring and background music shall be disengaged.

T. The system shall have power-limited circuitry and class B wiring. Wiring terminal blocks will be removable and accept #18 - #12 AWG wire. Audio output voltage shall be selectable for 1V nominal line level, 25V, 70.7V, or 100V. The voice (live microphone or recorded message) frequency response shall be 275 Hz – 6.5 kHz +/- 2.4 dB, background music frequency response shall be 100 Hz – 15 kHz +/- 2.4 dB. The signal to noise ratio shall be better than 65 dB, dynamic range shall be better than 65 dB, total harmonic distortion shall be less than 1%.

U. A microphone shall be located within the main FACP.

V. For all microphones mounted remotely from the voice evacuation control unit, the circuit shall be supervised and activate a trouble signal if the circuit is disturbed.

W. The BDA/ECRES System shall be a single portfolio to meet any application across the US with all Public Safety frequency bands supported, various models available for UHF, VHF,700MHz, 800 MHz and multi-band. All-inclusive and fully integrated BDA with UL2524 In-building 2-Way Emergency Radio Communication Enhancement Systems listing, NFPA 72, CSFM listing, NFPA 1221 and IFC compliance. NEMA 4 Type (UL Type-4) Approved Equipment Enclosure and NEMA 3R Type (UL Type-3R) Approved Battery Enclosure. BDA Panel shall be provided with one dedicated 120-volt normal operating power and one additional 120-volt normal operating power circuit for the battery charger. All circuits shall be protected by circuit breakers of proper size.

2.03 REMOTE TRANSPONDER PANELS

A. Distributed Power Module panels (RPS) shall be provided where required. The cabinets shall be surface mounted with a locking door or cover.

B. The contractor shall supply power modules compatible with the fire alarm control panel. The power module must have 5 amps of output power. The Distributed Power Supply shall be capable of being connected via an RS-485 system bus (SBUS). The power module’s RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

C. The RPS panels shall accommodate all specified initiating device and command points. Each initiating circuit shall allow a 20 percent expansion of connected detection devices and 20 percent expansion of connected monitor/control points.

D. Normal system power shall be 120-volt AC power provided by dedicated circuits from the local emergency power panel. All circuits shall be protected by circuit breakers of proper size.

E. The RPS panels shall be provided with an emergency standby power system consisting of backup batteries. Batteries shall be sealed lead-acid or gel cell of sufficient capacity to provide 24 hours of standby operation plus 15 minutes in full alarm condition. All calculations shall allow a minimum of 20% safety factor for battery degradation. The loss of AC or DC power at any RPS shall cause a distinct power failure signal.

F. The RPS cabinets shall accept input/output (initiating, supervision, notification and/or command) modules for the specified points, zones and spares.

2.04 REMOTE POWER SUPPLIES/EXPANDERS

A. Provide as required additional power supplies for notification appliance circuits or as a remote power supply. The signal power expander supply/charger and batteries shall supply power limited 24 VDC operating and emergency power. The charger shall be capable of maintaining batteries in a fully charged state without damage and of bringing batteries from a fully discharged to a fully charged state within 48 hours of normal operation. Provide sufficient battery capacity for operation without AC power for twenty-four hours of normal supervision and five minutes alarm operation at the end of this period; include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries.

B. A minimum of four notification appliance circuit monitoring and control modules. The modules shall be designed to meet the required circuit Style Y configurations.

C. Strobe synchronization modules

D. Power supply with battery charger and standby batteries. Batteries shall be sized to meet the standby requirements of the FACP.

E. Supervision and activation by the main fire alarm system.

F. Each initiating circuit shall allow a 20 percent expansion

2.05 VOICE EVACUATION SPEAKER SIGNAL POWER EXPANDERS

A. Provide as required additional power supplies for voice evacuation speaker notification appliance circuits, for strobe notification appliance circuits, or as a remote power supply.

B. All interior strobe flashing shall be synchronized with external or built-in synchronization modules at one flash per second to meet UL 1971 requirements.

C. Each evacuation signal power expander supply/charger and batteries shall supply power limited 24 VDC operating and emergency power. The charger shall be capable of maintaining batteries in a fully charged state without damage and of bringing batteries from a fully discharged to a fully charged state within 48 hours of normal operation. Provide sufficient battery capacity for operation without AC power for twenty-four hours of normal supervision and five minutes alarm operation at the end of this period; include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries.

D. Each signal power expander shall have an engraved plastic nameplate permanently attached indicating the devices device identification number as documented. Labels shall be 1/16” thick two-ply black/white acrylic sheet engraving stock with all sides beveled.

E. Each signal power expander shall be connected to the FACP such that the trouble contacts on the power expander generate a trouble signal at the FACP.

F. Conduit shall enter the equipment backbox only where conduit entry is specified by the manufacturer.

G. Provide as required series auxiliary power supplies, each with one or two Farenhyt model VIP-50, 50 watt and/or VIP-125, 125-watt audio amplifiers as required, or equivalent.

2.06 EMERGENCY VOICE/ALARM SYSTEM (VOICE EVACUATION) STROBES, SPEAKERS, AND SPEAKER/STROBES

A. Provide where indicated on plans an emergency voice/alarm communications service system. The system shall automatically provide for speakers to broadcast a pre-recorded voice message operation on alarm that shall include an audible signal temporal pattern (Code 3) meeting ANSI S3.41 standards.

B. The system shall also provide for manual voice capability by keying the microphone, which shall override the pre-recorded message. The system shall be capable of emergency voice announcements at any time, whether the FACP is in alarm or not. Strobe operation shall be from the FACP or SPX and synchronized. Strobe operation shall not be interrupted by microphone activation.

C. Speakers shall be flush mount where possible and shall feature a high fidelity 400 to 4,000 Hz frequency response with 1/4 to 2-watt audio taps, 25 or 70 VRMS (field adjustable) providing approximately 77 to 90 dB @ 10 feet, varies by model. Horn Loudspeakers frequency response shall be 400 – 14,000 Hz.

D. Audible signals shall be tapped to provide at least 15 dB above ambient sound levels measured at 5 feet above the floor in the occupied area. Audible/Visual Signals shall conform to ADA standards. Furnish and install where shown on the drawings or as required per NFPA and any local, state, federal codes, or laws. Notification appliance circuits serving employee work areas shall be initially installed with a minimum of 20% spare capacity for visible notification appliances to facilitate future accommodation of hearing-impaired employees. Strobe intensity (candela output) and audible decibel level shall be sized for the room size and area of coverage per ADA and NFPA/ANSI standards. Signal housings and grilles shall be white in color. Audible signals (strobes and strobe speakers) shall be imprinted `FIRE' and the strobe lens shall be clear. All interior strobe flashing shall be synchronized.

E. Provide synchronization control such that all strobe circuits are synchronous, for all notification appliance circuits - System Sensor SpectrAlert Advance model MDL3W synchronization modules or equivalent. Note that signal appliances that can synchronize on a single circuit, but not across all circuits are not acceptable.

1. Ceiling Mount Speaker Only, **(USE WALL DEVICES UNLESS APPROVED IN SPECIFIC LOCATION BY OWNER**) select models to provide intelligibility as required per area. Shall be 6.5” minimum to 8” diameter cone speakers, UL 1480 listed fire-protective signaling devices with a line supervision capacitor. Speakers shall be designed for flush mounting with white grille and feature increased wattage, approximately 1/2 up to 5 watt audio transformer taps; AMK 6.5” 25watt rated loudspeaker coaxial enclosure with round white grille and tile bridge model SA615-EV-25v (25-v) or SA615-EV-70v (70-v), Quam 8” 20-watt rated loudspeakers with concentric mount hard fiber cone models: UL-7 round baffle

(25-v), UL-5 round baffle (70-v), U22/25 2' x 2' tile replacement with integrated back box (25-v), and U22/70 2' x 2' tile replacement with integrated back box (70-v), and TOA 8" with round white grille 10-watt rated speaker, 5 watt transformer, 70.7 V and 25 V model PC-580RU with HY-BB580 Back Can and Q-HY-TB2 tile bridge, or equivalents.

2. Ceiling Mount Speaker Strobes, small area (**USE WALL DEVICES UNLESS APPROVED IN SPECIFIC LOCATION BY OWNER)** – System Sensor SpectrAlert Advance model SPSCW low candela range/high fidelity, model SPSCWV low candela range/high decibel, or model SPSCWVH high candela range/high decibel. Low candela range 15/30/75/95/100 or 115, high candela range 135/150/177 or 185 candela, 1/4 up to 2-watt audio, flush mount with round white grille and trim plate – or equivalent. Semi-flush mounting requires support and a 4" square x 2.125" deep backbox. For drop ceiling installation, include a Bosch model SSB-4 or equivalent ceiling support bridge.

3. Wall Mount Speaker Only, System Sensor SpectrAlert Advance model SPW high fidelity or model SPWV high decibel 1/4 up to 2-watt audio, flush mount with rectangular white grille and trim plate – or equivalent. Semi-flush mounting requires a 4" square x 2.125" deep backbox.

4. Weatherproof exterior surface wall mount speaker strobe with audio output 1/4 up to 2 watts and visual output shall be set at 75 candela per UL 1638 and, with square white grille. Shall be System Sensor SpectrAlert Advance model SPSWK complete with wall mount plastic weatherproof back box featuring 3/4-inch top and bottom conduit entries and 3/4-inch knockouts at the back and a screw-in NPT plug with an O-ring gasket for a watertight seal or equivalent.

5. Exterior WATERFLOW ALARM, provide a weatherproof exterior surface wall mount speaker strobe with audio output 1/4 up to 2 watts and visual output shall be set at 75 candela per UL 1638 and, with square white grille. Shall be System Sensor SpectrAlert Advance model SPSWK complete with wall mount plastic weatherproof back box featuring 3/4-inch top and bottom conduit entries and 3/4-inch knock-outs at the back and a screw-in NPT plug with an O-ring gasket for a watertight seal or equivalent. . Also provide a weatherproof sign approximately 12" wide x 6" high, white with red letters reading, "WATERFLOW FIRE ALARM SIGNAL". Configure fire alarm system to activate this strobe signal on waterflow alarm only. Center signal and sign directly over Fire Department Connection (Siamese Port).

2.07 MAIN FIRE ALARM SYSTEM EQUIPMENT

A. Alarm Initiating Devices: All alarm initiating devices must be compatible with and UL listed with the fire alarm control panel

1. Point addressable heat detectors listed under UL Standard 521 shall be provided where indicated and where elevator machine rooms and elevator hoistways are sprinkled.

2. Analog addressable photoelectric smoke detectors shall be provided where indicated.

a. Analog addressable photoelectric smoke detectors shall be provided with integral LEDs to indicate detectors in alarm. The detectors shall operate from the two-wire signaling line circuit and be listed under UL Standard 268. Line transient and RFI protection shall be built into the detector.

b. Duct-mounted analog addressable smoke detectors shall be provided where indicated. Motor control wiring shall not be routed through the duct detector housing.

3. The beam smoke detector shall have an operating range of 30 feet by 320 feet and shall have a range of field selective sensitivity setting from 7% to 50% of higher total obscureness. The beam smoke detector shall provide continuous supervision and shall be provided with an automatic gain control that compensates for slow ambient visibility changes. The detector shall operate on 24 VDC from the nearest power source UL listed for that purpose. The detector shall be supervised for alarm and trouble conditions. The detector shall be installed in accordance with the manufacturer's instructions.

4. Addressable point monitoring interface modules shall be used to monitor the waterflow switches and fire suppression systems. The interface modules shall provide Style B electrical supervision of circuits to monitored devices.

B. Supervisory Devices:

1. Valve supervisory devices existing or new shall be furnished and installed by the Sprinkler Contractor and wired by this Contractor as indicated. The valve supervisory devices shall be installed to transmit a supervisory signal within the first two turns of the control valve handle.

2. Accessory relays shall be provided as needed to supervise equipment. All accessory relays shall be SPDT.

3. Addressable point monitor interface modules shall be used to monitor all supervisory points. The interface modules shall provide Styles B electrical supervision of circuits to monitored devices limited to five supervisory switches per initiating device circuit in one room.

C. Control Devices:

1. Provide control relays/contacts where required. The control relays/coils shall be 24-volt DC low voltage type each with number of contacts as required and housed in metal enclosure. The contacts shall be rated for 10 amps as required for continuous duty and for the control circuit voltage.

2. Addressable point control devices shall be used to provide all required control functions.

3. Coordinate all door hold open devices and fire doors with architectural hardware schedule. Provide all things required for code compliant system control.

D. ADA Emergency Call System:

1. Where required, provide and install an ADA Emergency Call System complete and in perfect operating order including boxes, conduit, wiring, telephones, master station and area station (at each rescue assistance area).

2. System:

a. Vandal resistant, 16-gauge, 304 stainless steel.

b. Comply with ADA.

c. Master station NEMA 1 or NEMA 4 (where required) enclosure with lockable door and plexiglass front.

d. Area Stations: Large domed stainless steel engraved 3” diameter button (Push for help) stations to be NEMA 1 or weather resistant where installed outside.

3. All cables shall be as recommended by manufacturer. All area stations must be home run with individually jacketed cable. All cables for exterior installations must be suitable for wet locations and appropriately grounded.

4. Install system per manufacturer’s requirements.

5. Confirm final locations of rescue assistance areas with Architect prior to rough-in.

E. SURGE PROTECTION FOR FIRE ALARM CONTROL UNITS

1. In addition to the built-in panel surge protection, each incoming 120 VAC power circuit shall be provided with an electrical surge protection module. Provide one for each fire alarm control unit, which includes every fire alarm control panel, digital communicator, signal power expander and any other 120 VAC powered fire alarm control units. Each power circuit surge protector module shall be mounted in a standard metallic electric box that is grounded and installed adjacent to the FACP, not inside the FACP. Module shall be hardwired in the incoming power circuit and 20 amp rated with 50kA surge current rating. Unit shall include Form C dry contacts for remote notification of surge protection status and LED diagnostic indicating light. Unit shall provide EMI/RFI filtering. Ditek DTK-120SRD or approved equivalent.

F. FIRE ALARM CIRCUIT SURGE PROTECTION

1. Electrical surge protection shall be provided for all entrance connections and on each copper pair that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both exit points to prevent damage to equipment.

2. Fire alarm system circuit surge protectors for SLC, PIV, and NAC circuits shall be mounted in a standard grounded metallic electric box or equipment backboard with a separate ground wire ran directly to the ground bus bar or equipment panel ground stud, do not daisy chain ground wires. Unit shall be mounted in the vicinity of the FACP but not inside the FACP. Each unit shall have a minimum 20kA rating and designed for an operating current of at least 5 amps for NAC and

PIV circuits and 1 amp for SLC circuits. Each unit shall include a staged hybrid design utilizing at least two different types of surge protection technology. Shall be Ditek 2MHLP or approved equivalent.

3. SLC Circuits shall be protected with Isolation devices per zone (floor level or region) so that “No single pathway fault shall cause the loss of more than 50 addressable devices on a signaling line circuit.”

G. FIRE ALARM COMMUNICATION CIRCUIT SURGE PROTECTION

1. Provide surge protection on all telephone communication circuits, Ethernet circuits, or external wireless antenna cables that wire directly to the FACP. Surge devices shall be UL listed for the application.

PART 3 - EXECUTION

3.01 INSTALLATION

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA code, National Electrical Code, the requirements contained herein, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ). The Fire Alarm Contractor shall furnish on-the-job supervision for the proper installation of devices in cooperation with, or as may be required by, other trades. This supervision shall include, but not be limited to, the following:

1. Provide specific on-site instructions to others on mounting and installation of each type of device by physically observing the mounting of one or more of each type of device, as required, to assure that the installer is properly instructed in the work.

2. Provide other supervision as required by the trades to properly interface fire alarm installation work.

3. Perform a complete test of all devices, certifying that all devices have been activated and that the devices and systems perform in accordance with the requirements of these specifications.

4. Install, test, troubleshoot and correct all system software provided under these specifications. This includes, but is not limited to, actual keyboard entry, reprogramming required to meet these specifications and any other task associated with the system software.

5. Provide all necessary submittals to the authority having jurisdiction.

B. The Fire Alarm Contractor shall furnish material and labor to provide a properly functioning system as described herein and in project drawings. The system shall operate in accordance with all the requirements of these specifications. No devices or equipment shall be used for any purposes other than their intended ones. This shall include, but not be limited to, the following:

1. Conduit, raceway and wiring systems shall be as indicated herein.

a. All exposed wiring shall be installed in conduit or wire mold.

b. All conduit fittings shall be threaded with plastic inserts

c. All riser wiring and wiring between floors shall be installed in conduit.

d. Conduit to waterflow and valve supervisory switches shall be weatherproof

e. Wiring, cables, conduits and raceways shall be neatly run parallel and perpendicular to building lines.

f. All raceways shall be of metal construction. Plastic conduits shall not be acceptable.

g. All cable not run in raceway shall be parallel/perpendicular to building lines and secured to the building structure. Provide bridal rings, D rings, or J hooks. Wire shall be neatly bundled with nylon wire ties at a minimum of four feet spacing.

h. All conduit shall be independently supported from structure. Conduit may not be supported from equipment, piping, ductwork or other trade's supports.

i. Do not route conduit under ductwork or other equipment.

2. Wire: All wire used on the fire signaling system shall be UL Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760.

a. Wire used for 120 VDC power circuits shall be minimum 12 AWG solid copper conductors, with THHN insulation and UL listed for fire alarm use.

b. All cables shall be plenum rated.

c. All wiring shall be appropriately sized based upon voltage drop calculations.

d. Any underground wire must be UL Listed for that purpose.

e. Do not run wiring under ductwork or other above ceiling equipment**.**

f. **All fire alarm wire shall match Owner special systems color code requirements, or red and/or red and white stripe only.**

SPK (Speaker)	**=**	**Blue**	**16/2 Shielded**
NAC (Audio/Visual, Door Hold Open)	**=**	**Yellow**	**14/2**
SLC (Smoke Detectors, Pull Stations, etc)	**=**	**Red**	**16/2**
SBUS (Communication Network)	**=**	**Red & Blue**	**16/4 Shielded**
HVAC SHUTDOWN	**=**	**Orange**	**16/2**

3. Junction Boxes:

   a. System components shall be securely fastened to the building structure. Devices shall not be supported by wiring or by other installed electrical fixtures or conduits.

   b. Each box shall be large enough to accommodate required splices and conduit in accordance with NFPA 70.

   c. System components shall be securely fastened to the building structure. Devices shall not be supported by wiring or by other installed electrical fixtures or conduits.

   d. Boxes at sprinkler risers shall be weatherproof.

   e. Provide box covers for all new and reused junction boxes.

4. Patching of all walls, floors, and ceilings which are penetrated or damaged during construction and returning the surface to a condition matching existing adjacent surfaces.

   a. All slab penetrations shall be completely sealed and made watertight.

   b. Restore all fire rated walls to rated conditions. All fire rated wall penetrations shall be made in conduit and sealed with UL Listed “fire stop” caulking.

5. Mounting:

   a. All devices shall be mounted in accordance with the manufacturer’s instructions and shall utilize the manufacturer’s suggested mounting box.

   b. Surface-mounted devices shall be smooth sided, without knockouts.

   c. Point addressable monitor modules and control modules shall be securely mounted in back boxes in an accessible location.

   d. Field devices shall be labeled, and all labeling recorded on “as-built drawings” indicate location, address and type of remote devices.

   e. Devices shall be flush or semi-flush mounted where possible.

   f. System components shall be placed and installed to comply with the Americans with Disabilities Act.

   g. All surface mounted devices shall be installed with appropriate back boxes. All work shall be neat and performed in a craftsman like manner.

   h. All devices, which are mounted behind walls, shall be provided with access panels. Location of access panels shall be coordinated with the Owner.

   i. Fire alarm system devices shall not be installed where they may interfere with the operation of other building systems, devices or features.

j. Devices and wiring installed in suspended ceilings shall be supported with appropriate bridge supports and ties.

6. **No cabling or conduit shall be run under ductwork, mechanical equipment or in front of access doors.**

C. Pay for all permits, fees and charges required for this work.

3.02 TESTS FIELD QUALITY CONTROL

A. The commissioning alarm test shall be coordinated with the Owner, Engineer and AHJ. A letter certifying that the installation is complete per drawings and specifications and fully operational per NFPA 72 shall be forwarded to the Owner and Engineer.

B. The Owner, Fire Alarm Contractor, Fire Alarm System Supplier, the Engineer and an authorized representative from each supplier of equipment shall be in attendance at the commissioning test to make necessary adjustments. A commissioning test shall be conducted in accordance with NFPA 72 and Authority Having Jurisdiction requirements. The test shall include, but not be limited to:

1. A test of the system for grounded, opened and shorted circuits.

2. A test of each alarm and new supervisory signal-initiating device for functions specified.

3. A test to verify that the alarm signals will operate under specified trouble conditions.

4. A test to verify that the components and wiring will operate under specified trouble conditions.

5. A test to verify that the system will perform all specified tasks.

C. VOICE INTELLIGIBILITY TESTING

1. Once the basic setup is complete, the gain structure is maximized, and the performance testing as outlined above is completed, this contractor shall conduct voice intelligibility testing as prescribed in the NFPA 72 and as follows:

a. The building shall be divided into Acoustically Distinguishable Spaces for testing by basic areas of the building and single rooms.

b. Final voice intelligibility testing shall be conducted in accordance with the test instrument manufactures written instructions and during normal hours of operation and under normal building occupancy conditions including all final room finishes, furnishings, and with a nominal number of occupants at their normal activity level, or as near as these conditions can be simulated. Simulation may include taking sample background noise measurements or “captured curves” for each designated ADS with stand in personnel for use in the testing process.

c. From each designated fixed-point test location in each ADS, the technician shall calibrate the test instrument, measure, and record the STI value while the test signal is played through the entire building emergency communication system.

d. Voice intelligibility test results for this emergency communication system will be acceptable if at least 90% of the measurement locations within each ADS has a measured STI of not less than 0.45 (CIS of not less than 0.65), and an average STI of not less than 0.50 (an average CIS of not less than 0.70). The contractor shall make any system adjustments or modifications needed for each ADS to pass the indelibility testing.

e. If an ADS does not meet the above requirements due to low readings, the testing procedures shall be verified, and adjustments made that may include increasing the volume of individual speakers, changing types or adding additional speakers, or working with the Architect to provide acoustical treatments that will reduce inordinate background noise and/or reverberation.

f. The final acceptance of the system by the Owner/Architect/Engineer will be based upon the proper performance of the completed system.

3.03 TRAINING

A. Provide training for the operating personnel in proper system operation and required user maintenance procedures.

B. The training program for the personnel shall include the following:

1. Three customized Operating & Maintenance Manuals – Printed, comprehensive installation and maintenance manuals, assembled with covers and conforming to the specified equipment supplied, shall be furnished with the equipment. The manual shall include a material guide which shall include the replacement part numbers and description of all components used. The manual shall provide sufficient, concise information, including schematics, troubleshooting diagrams, layout drawings, printed circuit overlays, test and alignment procedures, interconnect diagram parts list, compatibility charts and theory of operation of all active devices to permit quick, efficient maintenance and repair of the equipment by a competent Fire Alarm Systems Technician.

2. Two separate 1-hour training sessions for operating personnel. These sessions are to cover proper operating and response procedures. These instructions shall be sufficient to enable a previously untrained person to properly operate the system.

3.04 RECORD DOCUMENTS

A. Contractor to obtain architectural backgrounds for producing shop drawings from the Architect. Electrical Engineer cannot provide architectural backgrounds.

B. Provide two (2) full size prints, and a set of disks in AutoCAD 2004 format of drawings and wiring diagrams reflecting “as-built” conditions to the Owner.

C. Provide system map at FACP and FAAP.

D. Provide one (1) complete sets of “as-built” data sheets for all system-connected equipment to the Owner. (Hardcopy and PDF)

E. Provide two (2) sets (hard copies) of the complete “as-built” software listing of all data files, event programs, print statements, etc. to the Owner.

F. Provide a completed test form, which complies with NFPA 72, signed and dated by the fire alarm contractor.

G. Provide completion certificate, signed by the authority having jurisdiction.

H. Provide manufacturer’s recommended cleaning procedure for smoke detectors.

I. Provide additional copy of Record Drawings in Document Box.

J. Provide PDF set of As-Built Documents and data sheets on a thumb drive, labeled and left inside FACP.

K. Provide all program files on USB drive to owner upon completion of system programming.

END OF SECTION