



Addendum No. 3

Project: **Beaumont Independent School District New Transportation Center**

Date: **October 23, 2024**

All bidders/proposers are herewith notified of the following additions, deletions, changes or clarification to the drawings dated August 23, 2024, and shall be acknowledged as received on the proposal form.

CORRECTIONS/CLARIFICATIONS

SPECIFICATIONS

1. **The Soils Investigation Report** for the project site is attached with this addendum.
2. **Regarding Windstorm Inspections** for the project, the General Contractor will be responsible for the coordination of all windstorm inspections and all associated cost and will provide final the engineering report in the close-out documents.
3. **SECTION 07 46 16 – ALUMINUM SIDING (SIMULATED WOOD):** This specification section is attached with this addendum.
4. **SECTION 08 14 16 – FLUSH PLAM WOOD DOORS:** This specification section is attached with this addendum.
5. **SECTION 10 15 50 – PHENOLIC TOILET PARTITIONS:** This section is attached with this addendum.
6. **SECTION 12 24 13 – ROLLER WINDOW SHADES:** This section is attached with this addendum.
7. **SECTION 13 34 09 – PRE-ENGINEERED METAL BUILDING:** At Paragraph 1.1a.6; delete reference to an alternate price to add Liner Panels at the Maintenance Bay. Wall and Roof Integrated system equal to Owen Corning Optiliner Banded Liner System.
8. **SECTION 31 10 00 – SITE CLEARING:** Section is attached with this addendum.
9. **SECTION 31 20 00 – EARTHWORK:** Section is attached with this addendum.

10. **SECTION 31 31 16 – TERMITE CONTROL:** This specification section is attached with this addendum.
11. **SECTION 31 50 00 – EXCAVATION SUPPORT AND PROTECTION:** This specification section is attached with this addendum.
12. **SECTION 32 13 00 – PAVEMENT:** Section is attached with this addendum.
13. **SECTION 33 40 00 – STORM DRAINAGE:** Section is attached with this addendum.

CIVIL AND ARCHITECTURAL DRAWINGS:

1. **Sheet C202 - Civil Site Plan** – Add the following note: Paint all new and re-striping of the existing bus and car parking lot striping (car and bus areas) utilizing RAE Inverted Traffic Marking Paint (alkyd) as manufactured by Grainger Industrial Supply or other prior approved by the architect manufacturer (verify color). This will include restriping and adding numbering to all existing bus parking spots for this site as noted on the drawings with designation starting point to be confirmed with the Owner prior to start of paint application.
2. **Sheet A100** – Clarify all new fencing noted on this drawing will be furnished and installed by the owner including connecting fence each end of the building and the mechanical equipment pad enclosure. Additionally, the owner will coordinate the furnishing and installation of the mechanical equipment enclosure fencing after final confirmation of the layout of this space with the awarded contractor, and gate size requirements.
3. **Sheet A100** – Add that the general contractor is to provide roller shades at each of the narrow Type D windows on the north wall of the building (Reference attached Section 12 24 13 - Roller Window Shades.)
4. **Sheet A100** – Clarify: No flagpole will be erected on this site under this project contract but might be considered as the final landscape plan is developed.
5. **Sheet A103A** - The schedule designates the lockers will be by the Owner. Please disregard the locker section in the specifications as they will be provided by the owner under a separate contract.
6. **Sheet A301** – Clarify: In Maintenance Service Bay 143, the General Contractor to provide under the base bid, structural beams by the metal building manufacturer to support an owner provided/installed fall protection rail systems spanning along the length of these beams.
7. **Sheet A301** – Clarify: In Maintenance Service Bay 143, the General Contractor to provide SMP-I acrylic finished soffit liner panels secured across bottoms of the roof purlins, and in

the Open Air Maintain Bay 151, provide SMP-E Kynar finished soffit panels secured to the bottom of the roof purlins compliant for windstorm rated design and rust resistance.

8. **Sheet A403** – Clarify: All toilet and urinal partitions to be phenolic fabrication per attached Specifications Section 10155 Phenolic Toilet Partitions attached with this addendum.
9. **Sheet A404** – Clarify: All lockers, like all furnishings throughout the project, will be furnished and installed by the Owner under a separate contract; however, the general contract must verify the dimension requirement and furnish-install the CMU base for the lockers as indicated on the drawings in coordination with the Owner's selected lockers.
10. **Sheet A600** – Elevation 2, note the main entrance canopy is not by the pre-engineered metal building supplier and is custom for the project. All other wall mounted canopies are furnished and installed by pre-engineered metal building supplier. All other wall mounted canopies are furnished and installed by pre-engineered metal building supplier.
11. **Sheet A710** – Wall Section 3, note the main entrance canopy is not by the pre-engineered metal building supplier and is custom for the project. All other wall mounted canopies are furnished and installed by pre-engineered metal building supplier.
12. **Sheet F101** - Left hand side of drawings support rooms for the apparatus base indicate an incorrect hatching mark designating LVT tile. This area should have sealed concrete all spaces.
13. **Sheet F102** – Changes to Designations:
 - a. Electrical Room 202 change floor designated finish from LT-1 to SC-1
 - b. Corridor 103 change base designated finish from B-1T to TB-1.

MECHANICAL, ELECTRICAL AND PLUMBING SPECIFICATIONS AND DRAWINGS:

Reference attached documents from Salas O' Brien.

Architectural Alliance, Inc.



J. Rob Clark, AIA



SEL

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS TESTING

**GEOTECHNICAL INVESTIGATION
FOR
PROPOSED BEAUMONT I.S.D. TRANSPORTATION CENTER
IN
BEAUMONT, TEXAS**

REPORT NUMBER 24205

REPORTED TO:

**FITZ & SHIPMAN, INC.
1405 CORNERSTONE COURT
BEAUMONT, TEXAS 77707**

AUGUST 2024

**PREPARED BY:
SCIENCE ENGINEERING, LTD.**

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**GEOTECHNICAL INVESTIGATION
Proposed Transportation Center
Beaumont, Texas**

INTRODUCTION

The study reported herein is an investigation of subsurface conditions for the new Beaumont I.S.D. Transportation Center in Beaumont, Texas.

AUTHORIZATION

This investigation was authorized by Mr. Bernardino D. Tristan, P.E. by a signed proposal dated August 5, 2024.

SUBSURFACE EXPLORATION

The subsurface exploration at the site was accomplished by means of four (4) undisturbed sample core borings drilled to depths varying from five to twenty (5-20) feet below the existing ground surface. The approximate locations of the borings are shown on the attached boring plan.

SUBSURFACE INVESTIGATION

The subsurface investigation consisted of drilling three-inch nominal diameter core borings. Undisturbed samples of the cohesive soils were obtained from the borings by means of thin-wall, seamless steel Shelby tube samplers, in accordance with the ASTM D-1587 method. The shear strength of the cohesive soil samples was estimated by hand penetrometer in the field.

All undisturbed samples were extracted mechanically from the core barrels in the field, classified, wrapped in aluminum foil, and sealed in airtight plastic bags to prevent moisture loss and disturbance. The samples were transported to our laboratory for testing and further study.

LABORATORY INVESTIGATIONS

All samples from borings were examined and classified in the laboratory by a soil engineer, according to procedures outlined in ASTM D-2488. Laboratory tests were performed on selected soil samples in order to evaluate the engineering properties of the soil in accordance with the indicated standard procedures.

	ASTM Standard
Atterberg Limits [Liquid Limit (LL), Plastic Limit (PL), Plasticity Index (PI)]	D-4318
Soil Moisture Content	D-2216
Unconfined Compressive Strength	D-2166
Soils Classification	D-2487

The undrained shear strength of selective cohesive soils was determined by unconfined compression tests. Water content and dry unit weight of the foundation soils were determined as routine parts of the unconfined compression tests. Atterberg limits and tests were performed on the appropriate cohesive samples. The results of these tests are shown on the attached boring logs.

SUBSURFACE CONDITIONS

Specific types and depths of subsurface strata encountered on the site are shown on the attached boring logs. A review of the boring logs indicates that generalized stratigraphy is approximately as follows:

Stratum No.	Average Depth, feet	Soil Description
I	0.00 - 4.00	Gray SANDY CLAY (CL) with surface roots
II	4.00 -13.50	Tan, Red, and Gray CLAY (CH) with ferrous nodules and sand seams
III	13.50 -20.00	Tan and Gray SANDY CLAY (CL)

The near-surface soils are "CH" type soils when classified by the unified soils classification system. This type of soil normally exhibits high swell potential during seasonal moisture variations.

Hydrostatic water was encountered at the time of drilling as shown on the attached boring logs.

CONSTRUCTION VARIATIONS

The information contained in this report summarizes conditions found on the date that the borings were drilled. The depth of the static water table may be expected to vary with the

environmental variations, such as frequency and magnitude of precipitation and the time of year that construction begins.

DESIGN ANALYSIS AND RECOMMENDATIONS

Information available to this office indicates that the proposed construction at the site will consist of a new transportation building and related parking.

FOUNDATION RECOMMENDATIONS (BELL BOTTOM PIERS)

From the analysis of the boring logs and laboratory test results, structural loads can be transmitted to the foundation soils by the use of drilled and underreamed type footings. Footings should extend to a depth of eight (8) feet below the existing ground surface to be located in Tan and Gray Clay. Utilizing a minimum factor of safety of three for dead load, or a minimum factor of two for total load, the allowable bearing capacity of the foundation soils for circular type footings is as follows: **2,500 PSF** for dead load, plus long-term live loads, and **3,700 PSF** for total load. Whichever is critical should be used. The allowable loads given can be increased by thirty (30) percent for wind or temporary lateral loading.

Due to sand seams type soil at the recommended depth, we suggest that the bell-to-shaft ratio for the footings be limited to two to one (2:1).

There is a potential for upward movement of the plastic clays in contact with the sides of the piers; the pier shafts should be well reinforced throughout their length to resist tensional force.

FLOOR SLABS AND GRADE BEAMS

A review of the Atterberg Limits determinations indicates that the surface soils are "CH" type soils, with high plasticity, which may exhibit expansion during seasonal wetting and drying cycles. We believe that conventional "slab-on-fill" construction may be used for the interior portion of the structures built at the site. Select fill, a minimum of thirty-six (36) inch thickness should be used to bring the structure to grade.

Prior to placement of select fill, strip the site sufficiently to remove all topsoil, existing vegetation, and roots larger than ½" in diameter to an approximate depth of thirty-six (36) inches. Then scarify the subgrade, add moisture, if necessary, and re-compact to 95% of the maximum dry density as determined by ASTM D-698 (Standard Proctor). The moisture content at the time of compaction of subgrade soils should be within +3% of the proctor optimum value.

Select fill should then be placed, under laboratory control, in no greater than eight-inch (8") loose layers and compacted to a minimum of 95% of the maximum dry unit weight, as obtained in the laboratory by means of ASTM D-698 procedure. The moisture content of $\pm 2\%$ optimum should be maintained during the placement of the select fill material. A vapor barrier consisting of six (6) mil Polyethylene shall be placed between the select fill and concrete slab.

The material used as select fill should consist of a non-active sandy clay or clayey sand-type substance, having a Liquid Limit of 36 or less and Plasticity Index (P.I.) varying from 10 to 20.

STRUCTURE FOUNDATION

Each footing excavation should be inspected by the project's Engineer, Architect, or Owner's representative prior to placing concrete to ensure that (a) the footing has been constructed at the correct depth and the correct formation established by previously mentioned criteria, (b) the footing is concentric with the pier shaft or column, and (c) excessive cuttings, build-up or any soft-compressible material(s) have been removed from the bottom of the excavation.

Placement of concrete should be accomplished as soon as possible to prevent changes in the state of stress and the caving of the foundation soils. No footings should be poured without the prior approval of the projects' Engineer, Architect, or Owner's representative.

UPLIFT RESISTANCE

The ultimate capacity of underreamed type footings to resist uplift loads can be determined from the following equations developed by Turner⁽¹⁾:

Equation 1. The ratio of footing depth to bell diameter (L/D) is greater than 1.5:

$$Q_u = 5.8c (D^2 - d^2)$$

Equation 2. The ratio of footing depth to bell diameter (L/D) is less than 1.5:

$$Q_u = 2.1c^{0.5} (L/D)^2 (D^2 - d^2)$$

Where as ' Q_u ' is the ultimate uplift capacity in pounds, ' c ' is the average cohesive strength of the soils above the footing grade in pounds per square foot, ' D ' is the underreamed diameter in feet, and ' d ' is the shaft diameter in feet and ' L ' is the depth of the base of footing in feet. A design shear strength, ' c ', of 700 PSF is recommended for definition of ultimate uplift. A factor of safety of not less than 2.0 is recommended for final design

(1) Turner, E.A. (1962). "Uplift Resistance of Transmission Tower Footings," *Journal of the Power Division*. ASCE, Vol. 88, No. P02; pp. 17-33.

Note: The following method of interpretation for these equations is recommended for definition of the uplift capacity for a given footing:

1. When the depth-diameter ratio approaches 1.5, maximum uplift capacity will be the lesser value given by Equation 1 or Equation 2
2. When the depth-diameter ratio is greater than 1.5, the maximum uplift capacity is defined by Equation 1.

FOUNDATION SETTLEMENT

A detailed settlement analysis was not within the scope of this study. It is anticipated that the footings designed, using the recommended allowable bearing pressures, will experience small settlements that will be well within the tolerable limit for the proposed structure.

PORTLAND CEMENT CONCRETE PAVEMENT

Concrete paving may be constructed using a Portland Cement Reinforced Concrete Pavement. A seven-inch (7") minimum thickness should be used. For entrances, a nine-inch (9") over a six-inch (6") limestone base should be considered. The thickness of the paving should meet the minimum requirements of the City of Beaumont.

Subgrade preparation should consist of removing all topsoil and roots larger than ½" in diameter to an approximate depth of twelve (12) inches. Then scarify the subgrade to a depth of eight (8) inches and re-compact to a minimum of 95% of Standard Proctor Density (ASTM D-698). Base material should then be placed and compacted to a minimum of 95% of Modified Proctor Density (ASTM D-1557).

SITE PREPARATION

In order to remedy construction problems, which may develop if attempts are made to work the surface materials following prolonged periods of rainfall which are common to this area, it is recommended that prior to starting any work at the site proper construction drainage is to be provided to maintain a relatively dry construction site. (Use a minimum slope of 5% within 10 feet of the foundation).

LIMITATIONS

The conclusions and recommendations given in this report are based on the analysis of the data collected for this project. Additive conclusions or recommendations made from this data by others are their responsibility.

Our study is based on the data obtained from soil borings made at the locations shown on borings plan. The nature and extent of variations between borings may become evident during construction. We should be requested to observe exposed conditions. After making these observations, and noting the engineering significance of variations, we will advise you of any changes in recommendations believed appropriate.

We appreciate this opportunity to provide our services to this project. Please let us know if you require additional information. Thank you.

**Respectfully submitted for the firm,
TBPE Registration No. 4060**

The image shows a handwritten signature in blue ink, which appears to be 'YR', next to a circular professional engineer seal. The seal is for the State of Texas, featuring a star in the center. The text around the star reads 'STATE OF TEXAS' at the top and 'LICENSED PROFESSIONAL ENGINEER' at the bottom. In the middle of the seal, the name 'YUSEF RAHMANI' and the number '66273' are printed.

**Yousef Rahmani, P.E.
President**

Encl.: Boring Plan
 Boring Logs 1 – 4
 Geotechnical Chart/Symbols

Copies: 1 – Client
 1 – SEL File 24205

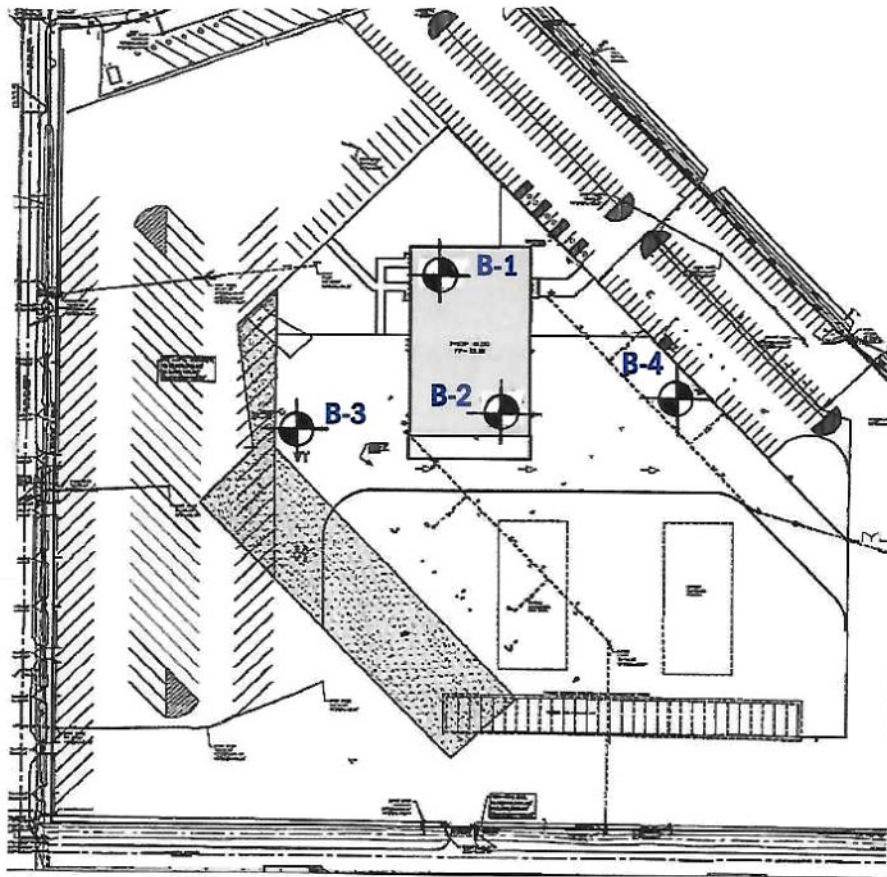
YR/nb



SEL

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS TESTING

Report Number 24205



**PROPOSED BEAUMONT I.S.D. TRANSPORTATION CENTER
BEAUMONT, TEXAS**

BORING PLAN

AUGUST 2024

NOT TO SCALE



LOG OF BORING

Project: Proposed Beaumont ISD Transportation Center
Beaumont, Texas

Project No: 24205

Boring Number: B-1

Date of Report: 08/19/2024

Location: See boring plan

Date of Boring: 08/07/2024

Dry Auger: 0 to 20 Feet

Authorization: Mr. Bernardino D. Tristan, PE

DEPTH, FEET	SYMBOL	SAMPLE	BLOWS PER FOOT	STRATUM DESCRIPTION	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	PERCENT PASSING NO. 200 SIEVE	SHEAR STRENGTH	
											POCKET PENETROMETER (TSF)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
				Gray SANDY CLAY with Roots			36	18	18			
				— gravel								
				CL								
5				Tan and Gray CLAY with ferrous nodules	23	101	63	24	39		0.75	0.68
											1.00	
10				— sand seams	21	101	50	21	29		1.25	0.61
					23	100	43	20	23		1.00	0.34
				CH								
15				Tan and Gray SANDY CLAY	24	98	60	24	36		1.50	0.80
				CL								
20					19	109	42	19	23		1.00	0.77
				Bottom at 20 feet								
				1. Water was encountered at 13' - 0" during drilling.								
				2. Water level was at 12' - 7" upon completion.								
				3. Water level was at 10' - 10" after 5 minutes.								



LOG OF BORING

Project: Proposed Beaumont ISD Transportation Center
Beaumont, Texas

Project No: 24205

Boring Number: B-2

Date of Report: 08/19/2024

Location: See boring plan

Date of Boring: 08/07/2024

Dry Auger: 0 to 20 Feet

Authorization: Mr. Bernardino D. Tristan, PE

DEPTH, FEET	SYMBOL	SAMPLE	BLOWS PER FOOT	STRATUM DESCRIPTION	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	PERCENT PASSING NO. 200 SIEVE	SHEAR STRENGTH	
											POCKET PENETROMETER (TSF)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
				Gray CLAYEY SILT								
				ML								
				Red and Gray CLAY with ferrous nodules	24	93	77	25	52		0.65	0.95
5				tan and gray							1.00	
					27	98	50	23	27		1.25	0.70
10					18	105	68	24	44		1.25	0.90
				CH								
				Tan and Gray SANDY CLAY								
15					26	98	35	17	18		1.00	0.25
				CL	18	111	28	17	11		1.00	0.49
20				Bottom at 20 feet								
				1. Water was encountered at 13' - 0" during drilling.								
				2. Water level was at 12' - 6" upon completion.								
				3. Water level was at 10' - 5" after 5 minutes.								

LOG OF BORING

Project:	Proposed Beaumont ISD Transportation Center Beaumont, Texas
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Boring Number: B-3

Location: See boring plan

Dry Auger:	---	to	5	Feet
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Project No: 24205

Date of Report: 08/19/2024

Date of Boring: 08/07/2024

Authorization: Mr. Bernardino D. Tristan, PE

DEPTH, FEET	SYMBOL	SAMPLE	BLOWS PER FOOT	STRATUM DESCRIPTION	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	PERCENT PASSING NO. 200 SIEVE	SHEAR STRENGTH	
											POCKET PENETROMETER (TSF)	UNCONFINED COMPRESSIVE STRENGTH (TSF)
				Gray SANDY CLAY								
				— gray and tan			38	18	20		0.50	
					19	104	40	19	21		0.50	0.46
5				Bottom at 5 feet 1. No water was encountered during drilling. 2. Bore hole dry upon completion.								



LOG OF BORING

Authorization: Mr. Bernardino D. Tristan, PE

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Email: yousef@science-engineer.com



KEY TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPE

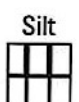


Gravel



Sand

Sandy



Silt

Silty



Clay

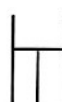
Clayey

Predominant type shown heavy

SAMPLE TYPE



Un-
Disturbed



Rock
Core



Split
Spoon



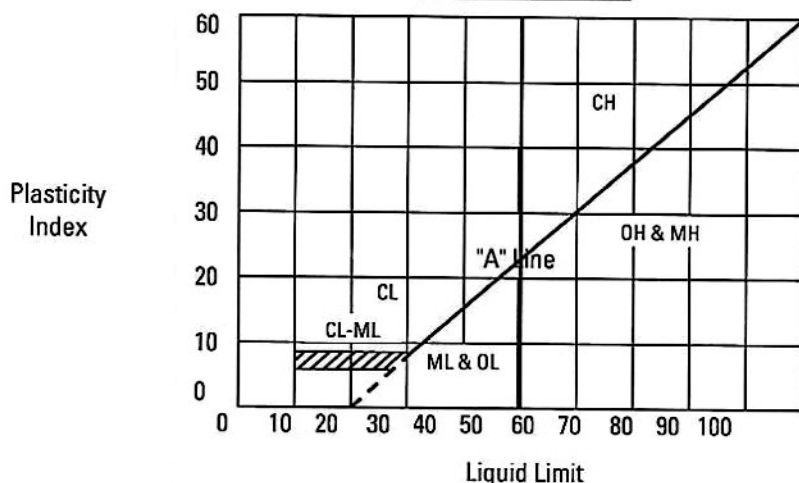
No
Recovery

SOIL GRAIN SIZE

U.S. Standard Sieve

6"	3"	3/4"	4	10	40	200	
Boulders	Cobbles	Gravel		Sand			
		Coarse	Fine	Coarse	Medium	Fine	Silt Clay
152	76.2	19.1	4.76	2.00	0.420	0.074	0.002 (mm)

PLASTICITY CHART



CONSISTENCY OF COHESIVE SOILS

Penetration Resistance, blows per foot	Consistency	Cohesion TSF	Plasticity Index	Degree of Plasticity
0 - 2	Very Soft	0 - 0.125	0 - 5	None
2 - 4	Soft	0.125 - 0.25	5 - 10	Low
4 - 8	Firm	0.25 - 0.5	10 - 20	Moderate
8 - 15	Stiff	0.5 - 1.0	20 - 40	Plastic
15 - 30	Very Stiff	1.0 - 2.0	> 40	Highly Plastic
> 30	Hard	> 2.0		

RELATIVE DENSITY OF COHESIONLESS SOILS

Penetration Resistance, blows per foot	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

SECTION 07 46 16 - ALUMINUM SIDING

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 aluminum siding and soffit.
- B. Related Requirements:
 - 1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
 - 2. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples for Initial Selection: For aluminum siding and soffit including related accessories.
- C. Samples for Verification: For each type, color, texture, and pattern required.
 - 1. ~~24-inch-~~ wide-by-~~36-inch-~~ high Sample panel of siding assembled on plywood backing.
 - 2. ~~12-inch-~~ long-by-actual-width Samples of trim and accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of aluminum siding and soffit.
- B. Research/Evaluation Reports: For each type of aluminum siding required, from ICC-ES.

- C. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.8 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. Furnish full lengths of aluminum siding and soffit including related accessories, in a quantity equal to 2 percent of amount installed.

1.9 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

- 1. Build mockups for siding and soffit including accessories.
 - a. Size: 48 inches long by 60 inches high .
 - b. Include outside corner on one end of mockup and inside corner on other end.
 - 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.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking , fading, and deforming.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than 5 Hunter color-difference units as measured according to ASTM D2244.
3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 ALUMINUM SIDING and SOFFIT

- A. Aluminum Siding: Formed and coated product complying with AAMA 1402.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Knotwood; a brand of Omnimax International.
 - b. Longboard.
 - c. RMP Alumaboard.
 - d. Fastplank Systems
- B. Horizontal Pattern: 8-inch exposure in plain, single-board style.
- C. Texture: Wood grain .
- D. Nominal Thickness: 1/2" .
- E. Finish: Manufacturer's standard Extremely Durable Powder Coatings: Premium Wood Finishes use a polyurethane powder coat with ink based wood grain patterns sublimated into the base powder effectively tattooing the powder. The combined effect creates all the aesthetic aspects of real wood while offering the same environmental advantages of powder coated finishes. .
 1. Colors: As selected by Architect.

2.3 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Aluminum Accessories: Where aluminum accessories are indicated, provide accessories complying with AAMA 1402.

1. Texture: Wood grain .
- C. Flashing: Provide aluminum flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 1. Finish for Aluminum Flashing: Same as aluminum siding .
- D. Fasteners:
 1. For fastening to metal, use zinc plated 8-18 phillos modified truss (R/W) Head screw., penetrating min three screw-threads, into substrate.
 2. For fastening aluminum, use aluminum fasteners. Where fasteners are exposed to view, use prefinished aluminum fasteners in color to match item being fastened.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of aluminum siding and soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 1. Center nails in elongated nailing slots without binding siding to allow for thermal movement.
- B. Install aluminum siding and soffit and related accessories according to AAMA 1402.
 1. Install fasteners no more than 24 inches o.c., or as required to meet windstorm requirements.
- C. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.
- D. Where aluminum siding contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 16

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with plastic-laminate-faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.

C. Samples: For plastic-laminate door faces .

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.

3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Basis of Design:
 1. VT Industries Heritage 303H for interior use only.
- B. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than **450 deg F** above ambient after 30 minutes of standard fire-test exposure.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards."
 1. Provide labels and certificates from AWI certification program indicating that doors and frames comply with requirements of grades specified.

2.3 FLUSH SOLID-CORE HIGH-PRESSURE DECORATIVE LAMINATE

- A. Interior Doors :
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

- a. VT Industries Inc.
 - b. ASSA ABLOY.
 - c. Curries.
 - d. Weyerhaeuser Company.
2. Performance Grade:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: All interior doors .
3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS .
4. Colors, Patterns, and Finishes: Formica 7012-58 Amber Maple. See Drawings
5. Exposed Vertical Edges: impact-resistant polymer edging, applied after faces.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
 - 1) Finish steel edges and astragals with baked enamel same color as doors.
 - 2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **550 lbf** in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - a) **5-inch** top-rail blocking, in doors indicated to have closers.
 - b) **5-inch** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 71 00 "Door Hardware."
 - b. Glued wood stave.
 - c. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Face: **550 lbf** .
 - 2) Screw Withdrawal, Edge: **550 lbf** .
 - d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
8. Vision Panels
 - a. VT Industries steel vision frame or equal
 - 1) Style No. 110
 - 2) Finish: Dark Bronze polyester powder coating to be Field Paint
9. Glazing: As specified in Section 8 80 00

- a. Non-fire rated applications use glazing tape and light torque on screws to prevent glass breakage.

2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Comply with applicable requirements in Section 08 80 00 "Glazing."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 1. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches**.
 2. Install fire-rated doors and frames in accordance with NFPA 80.
 3. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 4. Clearances:
 - a. Provide **1/8 inch** at heads, jambs, and between pairs of doors.
 - b. Provide **1/8 inch** from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide **1/4 inch** from bottom of door to top of threshold unless otherwise indicated.
 - d. Comply with NFPA 80 for fire-rated doors.
 5. Bevel non-fire-rated doors **1/8 inch in 2 inches** at lock and hinge edges.
 6. Bevel fire-rated doors **1/8 inch in 2 inches** at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

- A. Inspections:
1. Provide inspection of installed Work through AWI's Quality Certification Program , certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

Bus Parking and Maintenance Facility
Beaumont ISD

Section 08 14 16
Flush Wood Doors

END OF SECTION 08 14 16

SECTION 10 15 50
SOLID PHENOLIC PLASTIC TOILET PARTITIONS

PART 1 - GENERAL

1.01 Work Included

- A. Toilet Compartments
- B. Urinal Screens

1.02 Related Sections

- A. Wall backing required to secure mounting brackets.
- B. Support for floor-anchored compartments.
- C. Toilet room accessories.

1.03 References (including but not limited to)

- A. National Fire Protection Association 101 Life Safety Code, 2006 Edition, Chapter 10
- B. ANSI A117- 1986 Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- C. International Building Code (IBC), 2015 Edition
- D. International Plumbing Code (IPC), 2015 Edition
- E. Texas Accessibility Standards
- F. ADA, Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 144, Rules and Regulations.

1.04 QUALITY ASSURANCE

A. Manufacturers

- 1. Compartments shall be the product(s) of a single manufacturer.
- 2. Acceptable Manufacturers as applicable
 - a. Bobbrick
 - b. Bradley
 - c. Global Partitions
 - d. General Partitions
 - e. ASI Accurate Partitions
 - f. Scranton

1.05 Submittals

- A. Comply with requirements of Section regarding submittals.
- B. Manufacturer's Data

- 1. Provide required number copies of:
 - a. Product data sheets.
 - b. Installation instructions.
 - c. Replacement parts information.

C. Shop Drawings

- 1. Provide required number of copies of all shop drawings.
- 2. Show fabrication and erection of compartment assemblies, to extent not fully described by manufacturer's data sheets.
- 3. Show anchorage, accessory items and finishes.
- 4. Provide location drawings for bolt hole locations in supporting members for attachment of

compartments.

D. Samples

1. Furnish scale model of compartments, including stile, shoe, door, door hardware, divider panel, and mounting brackets.
2. Furnish sections showing stile anchoring and leveling devices, concealed threaded inserts, panel and stile construction and edge construction.

1.06 Product Delivery, Storage, and Handling

- A. Deliver items in manufacturer's original unopened protective packaging.
- B. Store materials in original protective packaging to prevent physical damage or wetting.
- C. Handle so as to prevent damage to finished surfaces.

1.07 Warranty

- A. Furnish ten-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.
- B. Furnish one-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

2.01 Configurations

- A. Toilet Compartments shall be:
Floor-Anchored
- B. Urinal Screens shall be:
Wall-Hung

2.02 Components/Materials

- A. Stiles, Panels, Doors, Screens, and Benches
 1. Solid phenolic material constructed of solidly fused plastic laminate with matte-finish melamine surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges shall be black. Brown edges shall not be acceptable. Color : See Finish Schedule
Code Class II, ASTM E-84 Fire Resistance Standards: flame spread 69, smoke density 93.
 2. Finish Thickness
 - a. Stiles and doors shall be 3/4" (19mm).
 - b. Panels and benches shall be 1/2" (13mm).
- B. Hardware
 1. All hardware to be 18-8, type-304 stainless steel with satin-finish.
 2. All hardware shall be concealed inside compartments with the exception of outswing doors.
 3. Hardware of chrome-plated "Zamak" is unacceptable.
- C. Latch
 1. Sliding door latch shall be 16-gauge (1.6mm).
 2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.

3. Latch track shall be attached to door by flathead machine screws into factory installed threaded brass inserts.
 4. Latch handle shall have rubber bumper to act as door stop.
 5. Latch shall allow door to be lifted over 16-gauge (1.6mm) keeper for emergency access.
 6. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.
- D. Hinges
1. Cam shall be adjustable in the field to permit door to be fully closed or partially open when compartment is unoccupied.
 2. Hinges shall be attached to door and stile by theft-resistant, one-way stainless steel machine screws into factory-installed metal inserts. Fasteners secured directly into the core are not acceptable.
 4. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.
- E. Clothes Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29mm) from face of door. Clothes hook shall be secured by theft-resistant, one-way stainless steel screws.
- F. Mounting Brackets shall be constructed of stainless steel and shall be mounted inside compartment. Mounting brackets exposed on the exterior of the compartment will not be acceptable. Wall mounted urinal screen brackets shall be 11-gauge (3mm) double thickness.
- G. Leveling Device shall be 3/16" (5mm) hot rolled steel bar; chromate-treated and zinc-plated; through- bolted to base of solid phenolic stile.
- H. Stile Shoe shall be one-piece, 4" (102mm) high, type-304, 22-gauge (0.8mm) stainless steel with satin- finish. Top shall have 90° return to stile. Patented one-piece shoe capable of adapting to 3/4" or 1" stile thickness and capable of being fastened (by clip) to stiles starting at wall line.
- I. Headrail (Overhead-Braced) shall be satin finish, extruded anodized aluminum (.065" / 1.65mm thick) with anti-grip profile.

PART 3 - EXECUTION

3.01 Inspection

- A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.
- B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.
- C. Do not begin installation of compartments until conditions are satisfactory.

3.02 Erection

- A. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.
- B. Installation methods shall conform to manufacturer's recommendations for backing and proper support.
- C. Conceal evidence of drilling, cutting, and fitting to room finish.
- D. Maintain uniform clearance at vertical edge of doors.

3.03 Adjustment and Cleaning

- A. Adjust hardware for proper operation after installation.
- B. Set hinge cam on inswinging doors to hold doors open when unlatched.
- C. Set hinge cam on outswinging doors to hold unlatched doors in closed position.
- D. Clean exposed surfaces of compartments, hardware, and fittings.

End of Section

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.
2. Motor-operated roller shades with single rollers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. BTX Intelligent Fashion, LLC.
 2. CACO, Inc.
 3. Draper, Inc.
 4. Hunter Douglas Architectural.
 5. Insolroll Window Shading Systems.
 6. Lafayette Interior Fashions.
 7. MechoShade Systems, LLC.
 8. Rollease Acmeda Inc.
 9. SM Automatic.
 10. Springs Window Fashions; SWFcontract.
 11. TimberBlindsMetroShade; Timberblinds, LLC.
- B. 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. Chain-Retainer Type: Clip, jamb mount .
- 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. Color and Finish: As selected by Architect from manufacturer's full range .
- F. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 3. Endcap Covers: To cover exposed endcaps.
 4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
 5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
 6. Installation Accessories Color and Finish: As selected from manufacturer's full range .

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. BTX Intelligent Fashion, LLC.

2. CACO, Inc.
 3. DFB Sales, Inc.
 4. Hunter Douglas Architectural.
 5. Insolroll Window Shading Systems.
 6. PowerShades.
 7. Rollease Acmeda Inc.
 8. TimberBlindsMetroShade; Timberblinds, LLC.
- B. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
 - a. Electrical Characteristics: 110-V ac .
 - b. Maximum Total Shade Width: As required to operate roller shades indicated .
 - c. Maximum Shade Drop: As required to operate roller shades indicated .
 - d. Maximum Weight Capacity: As required to operate roller shades indicated .
 3. Remote Control: Group wall-switch control station.
 4. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
- C. 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.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.
- F. Shadebands:
1. Shadeband Material: Light-filtering fabric .
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Color and Finish: As selected by Architect from manufacturer's full range .
- G. Installation Accessories:
1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 3. Endcap Covers: To cover exposed endcaps.

4. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
5. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
6. Installation Accessories Color and Finish: As selected from manufacturer's full range .

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. Color: As indicated on Drawings Match Architect's sample <Insert color>.
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 1. Source: Roller shade manufacturer .
 2. 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
- 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. 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 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. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- D. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- E. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 MATERIALS OWNERSHIP

Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.02 TRAFFIC

Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."

Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.01 Locate and clearly flag trees and vegetation to remain or to be relocated.

3.02 Protect existing site improvements to remain from damage during construction.

Restore damaged improvements to their original condition, as acceptable to Owner.

3.03 Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.04 Do not excavate within drip line of trees, unless otherwise indicated.

3.05 Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.06 Utilities: Locate, identify, disconnect, and seal or cap off utilities indicated to be removed. Do not interrupt utilities serving facilities occupied by Owner or other unless permitted. Arrange to provide temporary utility services.

Excavate for and remove underground utilities indicated to be removed.

- 3.07** Clearing and Grubbing: Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

Fill depressions with satisfactory select fill. Place select fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

- 3.08** Topsoil Stripping: Remove sod and grass before stripping topsoil. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stock piles to drain surface water. Cover to prevent windblown dust.

Existing topsoil may be used where topsoil is required in project plans or specifications.

- 3.09** Site Improvements: Remove existing above and below-grade improvements as indicated and as necessary to facilitate new construction.

- 3.10** Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 31 20 00

EARTHWORK

PART 1 - GENERAL

1.01 Related Documents

Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division-1 Specifications, apply to work of this section.

1.02 Description of Work:

- A. Extent of earthwork is indicated on drawings.
- B. Preparation of sub grade for roads, slabs, walks, and of pavements is included as part of this work.
- C. Backfilling of trenches is included as part of this work.
- D. Definition: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

1.03 Quality Assurance:

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service:
- C. All testing under this section is to be performed by the contractor at his expense.

1.04 Job Conditions:

- A. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protections during earthwork operations.
- B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult with utility owner immediately for directions. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
- D. Operate warning lights as recommended by authorities having jurisdiction.
- E. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

2.01 Soil Materials:

2.02 Definitions:

- A. Satisfactory Soils: Defined in Geotechnical Report for this project.
- B. Unsatisfactory Soils: Defined in Geotechnical Report for this project.

2.04 Structural Fill: Satisfactory soil materials free of clay, rock or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter. Select fill shall have a P.I.>10 but less than 20.

- A. Flexible Base: Limestone shall conform to TXDOT Specification 247.
- B. Cement Stabilized Sand: Cement Stabilized Sand shall be 1 ½ sacks of cement per ton of material unless otherwise noted on plans
- C. Prepared Natural Ground: Natural Ground which has been striped of vegetation and proof rolled per specifications.
- D. Sand: Naturally or artificially graded mixture of natural or crushed sand; ASTM D2940, with not more than 8 percent passing a No. 200 sieve.
- E. Pea Gravel: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- F. Subgrade: Existing or imported Select Fill materials below pavement or road sub base materials and finished surface courses or structures.
- G. Sub-base Course: Materials or treatments below pavement or roadway surface courses.
- H. Detectable Warning Tape: Polyethylene film warning tape encasing a metallic core, minimum 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility.

3.01 Excavation:

- A. Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at contractor's expense.
- C. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.
- D. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classifications, unless otherwise directed by Architect.

3.02 Additional Excavation: When excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions.

- A. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect.
- B. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

3.03 Stability of Excavations:

- A. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of materials excavated.
- B. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.04 Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.

- A. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- B. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

3.05 Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

- A. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
- B. Dispose of excess soil material and waste materials as herein specified.

3.06 Excavation for Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.07 Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown.

3.08 Excavation for Trenches:

- A. Dig trenches to uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit unless otherwise noted on plans.
- B. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations.

- C. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

3.09 Compaction: General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

- A. Proof roll existing natural ground, before filling or placing subgrade, with heavy Pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades. Soft spots shall be removed and backfilled with Select Fill.

3.10 Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils that exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D-1557.

3.11 Concrete Pavements: Compact top 12" of existing ground subgrade and each layer of backfill or fill material at 90% maximum density for cohesive material or 95% standard proctor density for cohesionless material except as shown on the plans.

3.12 Lawn or Unpaved Area: Compact top 6" of existing ground subgrade and each layer of material at 85% standard proctor density for cohesive soils and 90% standard proctor density for cohesionless soils.

3.13 Walkways: Compact top 6" of existing ground subgrade and each layer of material at 90% maximum density for cohesive material or 95% standard proctor density for cohesionless material.

3.14 Trenches: Place and compact trench backfill to the requirements detailed on the plans. All trenches below concrete or asphalt pavement shall be backfilled with cement stabilized sand to a level below the prescribed pavement subgrade treatment. All cement-stabilized sand in trenches shall be compacted to 90% maximum density. All cement stabilized sand backfill shall be placed in 12" lifts.

3.15 Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil, apply water in a manner to prevent free water appearing on surface during or subsequent to compaction operations. Maximum densities shall be attained at $\pm 2\%$ of optimum moisture.

Remove and replace, scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.16 Backfill and Fill:

- A. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below:
- B. In excavations, use satisfactory select fill or other material as shown on plans.
- C. Under grassed areas, use satisfactory select fill.

- D. Under walks and pavements, use subbase material, or satisfactory excavated or borrow material, or combination of both.
- E. Under steps, use structural fill material.
- F. Under building slabs, see structural notes and specifications.

3.17 Utility Trench Backfill:

- A. Place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch (25 mm), to a height of 12 inches (300 mm) over the utility pipe or conduit or as noted on plans. Place and compact final backfill of satisfactory soil material to final subgrade.
- B. Install warning tape, if required on plans, directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.
- C. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
 - 2. Inspection, testing, and approval.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.18 Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill materials will bond with existing surface.

When existing ground surface has a density of less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.

3.18 Placement and Compaction:

- A. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.
- B. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

- C. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.
- 3.20 Grading:** General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- 3.21 Grading Outside Building Lines:** Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
- Finish surfaces free from irregular, surface changes, and as follows:
- 3.22 Lawn or Unpaved Areas:** Finish areas to receive topsoil to within not more than 0.10' above or below required subgrade elevations.
- 3.23 Walks:** Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below required subgrade elevation.
- 3.24 Pavements:** Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below required subgrade elevation.
- 3.25 Compaction:** After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.
- 3.26 Grade Control:** During construction, maintain lines and grades including crown and cross-slope of sub-base course.
- 3.27 Placing:** Place sub-base course material on prepared subgrade in layers of uniform thickness, conforming to indicate cross-section and thickness. Maintain optimum moisture content for compacting sub-base material during placement operations.
- When a compacted sub-base course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.
- 3.28 Protection of Graded Areas:** Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- 3.29 Reconditioning Compacted Areas:** Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- 3.30 Disposal of Excess and Waste Materials:**
- Remove from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off owner's property in an approved manner.

END OF SECTION 31 20 00

SECTION 31 31 16

TERMITE CONTROL

PART 1 - GENERAL

- 1.1 SCOPE: Provide termite control work for new concrete foundations only.
- 1.2 RELATED WORK SPECIFIED ELSEWHERE:
 - A. Submittal procedures: Section 01340.
 - B. Cast-in-place concrete: Section 03300.
- 1.3 SUBMITTALS:
 - A. Product Data: Manufacturer's technical data and application instructions.
 - B. Certificates: Manufacturer's certification that products are in compliance with current environmental protection statutes.
 - C. All work and products must be selected based on the most current federal and state guidelines for permissible pest control products and applications.

PART 2 - PRODUCTS

- 2.1 2.01 SOIL TREATMENT SOLUTION:
 - A. Type: Emulsible concentrated insecticide for dilution with water specially formulated to prevent termite infestation.
 - B. Acceptable Termiticides:
 - 1. Termidor 80WG (fipronil)
 - 2. Aggreszor 75WSP (imidacloprid)
 - C. Dilute with water to concentrate level recommended by manufacturer.
 - D. Other solutions may be used as recommended by Contractor if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

- 3.1 SOLUTION APPLICATION AT BUILDING SLAB ONLY:
 - A. Apply termite control solution according to current EPA regulations.
 - B. Add chemically inert coloring agent to solution to indicate which areas have received treatment.
 - C. Apply to inside of foundation walls, along both sides of interior partition walls, and around plumbing penetrations.
 - D. Apply solution as overall treatment under interior slab and attached slab areas.
 - E. Apply solution along outside edge new and existing building, 3 inches above grade.
 - F. Allow minimum 12 hours for drying after application, before beginning concrete placement and other construction activities.
 - G. Post signs in areas of application with warning that soil poisoning has been applied.
 - H. **Reapply soil treatment solution to areas disturbed by subsequent excavation and other construction activities following application.** Application Company cannot certify this project until all exterior work has been completed including re-treatment after work by finishing grading and landscaping subcontractors.

END OF SECTION 31 31 16

SECTION 31 50 00

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

3.01 RELATED DOCUMENTS

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

3.02 SUMMARY

- A. Section includes temporary excavation support and protection systems.
- B. Related Sections:
 - 1. Division 01 Section Construction Progress Documentation for recording preexisting conditions and excavation support and protection system progress.
 - 2. Division 01 Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
 - 3. Division 31 Section "Dewatering" for dewatering system for excavations.

3.03 PERFORMANCE REQUIREMENTS

- A. Furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.
 - 1. Delegated Design: Design excavation support and protection system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 4. Monitor vibrations, settlements, and movements.

3.04 SUBMITTALS

- A. Shop Drawings: For excavation support and protection system.
- B. Delegated-Design Submittal: For excavation support and protection system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Other Informational Submittals:
 - 1. Record Drawings: Identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

3.05QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to excavation support and protection system including, but not limited to, the following:
 - a. Geotechnical report.
 - b. Existing utilities and subsurface conditions.
 - c. Proposed excavations.
 - d. Proposed equipment.
 - e. Monitoring of excavation support and protection system.
 - f. Working area location and stability.
 - g. Coordination with waterproofing.
 - h. Abandonment or removal of excavation support and protection system.

3.06PROJECT CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of utility.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from the data.
 - 1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
 - 2. The geotechnical report is referenced elsewhere in the Project Manual.

PART 2 - PRODUCTS

3.01MATERIALS

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel: ASTMA36.
- C. Steel Sheet Piling: ASTMA328; with continuous interlocks.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.
- E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
- F. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

- G. Tiebacks: Steel bars, ASTM A 722/A 722M.
- H. Tiebacks: Steel strand, ASTM A 416/A 416M.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
 - 1. Shore, support, and protect utilities encountered.
- B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces are not impeded.
- D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
- E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.02 SOLDIER PILES AND LAGGING

- A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.
- B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.
- C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

3.03 BRACING

- A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.04REMOVAL AND REPAIRS

- A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
 1. Remove excavation support and protection systems to a minimum depth of 48 inches (1200 mm) below overlaying construction and abandon remainder.
 2. Fill voids immediately with approved backfill compacted to density specified in Division 31 Section "Earth Moving."
 3. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.
- B. Leave excavation support and protection systems permanently in place.

END OF SECTION

SECTION 32 13 00

CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

- 1.1 Submittals: In addition to Product Data, submit design mixes for each concrete pavement mix.

Submit material certificates signed by manufacturers certifying that each concrete material complies with requirements.

- 1.2 Quality Assurance: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

PART 2 - PRODUCTS

- 2.1 Form Materials: As noted on plans

- 2.2 Steel Reinforcement Materials: As follows:

Plain-Steel Welded Wire Fabric: ASTM A 185, flat sheets.

Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.

Plain Steel Wire: ASTM A 82, as drawn.

Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening steel reinforcement; manufactured according to CRSI's "Manual of Standard Practice"

- 2.3 Concrete Materials: As follows:

Portland Cement: ASTM C 150, Type I or II for all area paving, curbs, sidewalks, and other applications

Fly Ash: ASTM C 618, Class F or C.

Aggregate: ASTM C 33, uniformly graded, from a single source.

Water: ASTM C 94.

- 2.4 Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures, as follows:

Air-Entraining Admixture: ASTM C 260.

Water-Reducing Admixture: ASTM C 494, Type A.

High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.5 Curing Materials: As follows:

White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.6 Related Materials: As follows:

Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork

Coloring Agent: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis..

2.7 Concrete Mixes: Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, with the following properties or as noted on the plans:

Driveways, Parking, Curbs, and sidewalks: Compressive Strength (28 Days): 3000 psi.

Roadways: as noted on plans (min Flexural strength 550 psi)

For all full depth concrete paving repairs: Compressive Strength (28 Days): 5000 psi, Class "K" Type III.

Maximum Water-Cementitious Materials Ratio: 0.50.

Slump Limit: 2-4 inches or 4-7 inches for a flowable concrete design mix.

2.8 Coloring Agent: Add coloring agent to mix according to manufacturer's written instructions.

2.9 Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

PART 3 - EXECUTION

3.1 Surface Preparation: Proof-roll prepared subbase, and remove loose material from surface.

3.2 Forms: Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.

3.3 Reinforcement: Accurately position and support reinforcement, and secure against displacement. Set wire ties with ends directed into concrete.

Install welded wire fabric in lengths as long as practicable; lap at least one full mesh, and lace splices with wire.

- 3.4 Joints: Locate and install construction, isolation, contraction, and expansion joints as indicated. Sawed joints shall be sawed within 12 hours of concrete placement or as soon as concrete can be cut with out spawling or imprinting of saw cutting equipment.

- 3.5 Concrete Placement: Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete. Place concrete in a continuous operation within planned joints or sections.

Moisten subbase to provide a uniform dampened condition at time concrete is placed.

Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping according to recommendations in ACI 309R.

Screed and initial-float concrete surfaces with darby or bull float before excess moisture or bleed water appears on the surface.

Protect concrete from cold or hot weather during mixing, placing, and curing.

- 3.6 Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surfaces to true planes with gaps below 10-foot long, unleveled straightedge not to exceed 1/16 inch. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

- 3.7 Curing: Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Cure concrete by one or a combination of the following methods:

Moisture cure concrete by water, continuous fog spray, continuously wet absorptive cover, or by moisture-retaining-cover curing. Keep surfaces continuously moist for not less than seven days.

Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- 3.8 Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section. All repairs shall be full depth and concrete used shall be Class "K" Type III concrete.

- 3.9 Protect concrete from damage. Exclude traffic from pavement for at least 7 days after placement, and only after approval from owner based upon concrete testing results.

- 3.10 Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE

PART 1 - GENERAL

- 1.1 Submit Product Data for HDPE pipe and pipe appertenances.
- 1.2 Submit Shop Drawings for precast concrete surface inlets and gratings.

PART 2 - PRODUCTS

- 2.1 Corrugated HDPE Pipe and Fittings, ADS N-12 or equal: AASHTO M 294, Type S, with smooth waterway for coupling joints.

Watertight Couplings: AASHTO M 294, corrugated, matching pipe and fittings to form watertight joints.
- 2.2 PVC Storm Sewer Pipe and Fittings, 8 inch diameter and Smaller: ASTM D 3034, SCH 40, for gasketed joints if connected directly to a PVC roof drain.

Gaskets: ASTM F 477, elastomeric seals.
- 2.3 Sleeve-Type Pipe Couplings: ASTM C 1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.
- 2.4 Concrete: Cast in place according to ACI 318, ACI 350R, and the following:

Cement: ASTM C 150, Type II.

Fine Aggregate: ASTM C 33, sand.

Coarse Aggregate: ASTM C 33, crushed gravel.

Water: Potable.
- 2.5 Portland Cement Design Mix: Class "A" (3,000 psi,@28 days minimum), with 0.45 maximum water-cementitious materials ratio.

Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.

Reinforcement Bars: ASTM A 615/A 615M, Grade 60 , deformed steel.

Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

PART 3 - EXECUTION

- 3.1 Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."
- 3.2 Identification: Materials and their installation are specified in Division 2 Section "Earthwork."
Arrange for installing green warning tapes directly over piping.

Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.3 Piping Applications: Include watertight joints.

NPS 4 to NPS 30: HDPE corrugated outside, smooth wall inside, drainage pipe and fittings, watertight bell and spigot fittings ADS N-12 Pro-Link Ultra or equal

NPS 3 to NPS 12: PVC schedule 40 pipe and fittings, gaskets, and gasketed joints.

3.4 Sleeve-Type Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

3.5 General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

3.6 Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

3.7 Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

3.8 Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

3.9 Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

Install piping pitched down in direction of flow, at slopes indicated on drawings.

Install piping with 1 foot (12 inch) minimum cover.

3.10 Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

3.11 Pipe Joint Construction and Installation: Join and install pipe and fittings according to installations indicated.

HDPE Pipe and Fittings: As follows:

Join pipe and fittings with couplings for watertight joints according to manufacturer's written instructions.

Install according to ASTM D 2321 and manufacturer's written instructions.
Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."

PVC Pipe and Fittings: As follows:

Join pipe and gasketed fittings with gaskets according to ASTM D 2321.

Install according to ASTM D 2321.

Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

- 3.11 Surface Inlet Installation: Install complete with appurtenances and accessories indicated.

Set tops of frames and grates flush with finished surface of surface inlet that occur in pavements.

All exposed concrete corners of manholes, inlets, or other structures shall be chamfered 1".

Contractor shall backfill around all manholes, inlets, and catch basins, with cement stabilized sand. Cement stabilized sand shall not contain less than 1 ½ sacks cement per total ton of mixture.

- 3.12 Concrete Placement: Place cast-in-place concrete according to ACI 318 and ACI 350R.

- 3.13 Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

Place plug in end of incomplete piping at end of day and when work stops.

Flush piping between manholes and other structures to remove collected debris

- 3.14 Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

Defects of pipe or surface inlets installation requiring correction include the following:

Alignment: Less than full diameter of inside of pipe is visible between structures.

Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

Crushed, broken, cracked, or otherwise damaged piping.

Infiltration: Water leakage into surface inlet around pipe.

Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

Reinspect and repeat procedure until results are satisfactory.

END OF SECTION

Bradley Kalmans



October 23, 2024

RE: Beaumont ISD - New Transportation Center
SOBE #017-2022-01042

Subj.: Addendum #3



10/23/2024

SPECIFICATIONS

1. **SECTION 23 09 33 – BUILDING MANAGEMENT AND CONTROL SYSTEM**
 - a. Re-issue section in its entirety.
2. **SECTION 23 31 13 – DUCTWORK**
 - a. Add this section in its entirety.
3. **SECTION 27 10 00 - STRUCTURED CABLING SYSTEM (SCS)**
 - a. To Article 2.2 'APPROVED MANUFACTURERS':
 - a. Revise Paragraph A, Subparagraph 1, Number C to read 'Leviton/Berk-Tek.'
 - b. Revise Paragraph A, Subparagraph 2, Number D to read 'Leviton/Berk-Tek.'
 - c. Revise Paragraph B, Subparagraph 3 to read 'Leviton/Berk-Tek.'
4. **SECTION 28 10 00 - ACCESS CONTROL SYSTEM (ACS)**
 - a. Re-issue section in its entirety.
5. **SECTION 28 20 00 - VIDEO SURVEILLANCE SYSTEM (VSS)**
 - a. Re-issue section in its entirety.

CHANGES TO THE DRAWINGS

1. Sheet E300 – ELECTRICAL POEWR FLOOR PLAN
 - a. Route 2#10, 1#10G., 3/4"C. from panel LB to EUH-3. Provide with 30A/2P/NF disconnect switch and make final connection.
 - b. Sprinkler Riser, revise disconnect for EUH-2 to 30/2P/NF.
 - c. Mechanical 118, revise disconnect for EUH-2 to 30/2P/NF.
 - d. Replace sheet in its entirety.
2. Sheet E500 – ELECTRICAL PANEL SCHEDULES
 - a. Panel EQLA, revise breaker and wire for EUH-2 to 30A/2P and #10awg.
3. Sheet E501 – ELECTRICAL PANEL SCHEDULES
 - a. Panel LA, revise breaker and wire for EUH-1 to 30A/2P and #10awg.
 - b. Panel LB, add (1)30A/2P circuit breaker with #10awg for EUH-3.
4. Sheet P300 – PLUMBING FLOOR PLAN
 - a. Shift gas meter plan east and gas entry into the building to avoid hydronic piping from chiller.
5. SHEET M101 –MECHANICAL FLOOR PLAN
 - a. Add Electric unit heater EUH-3 in FLUIDS 150.
 - b. Add CO sensor southwest in MAINTENANCE BAY 143.
 - c. Add CO sensor northeast in MAINTENANCE BAY 143.
 - d. Relocate VAV-1-8 in TRAINING ROOM 128.
 - e. Add keynote #29 and #30.
 - f. Replace sheet in its entirety.
6. SHEET M201 – MECHANICAL ENLARGED PLAN "MECHANICAL YARD AND CENTRAL PLANT"



- a. Reroute Hot water supply and return piping for the boiler B-1.
 - b. Relocate 3-way valve.
 - c. Run refrigerant pipe from DXCU-1.
 - d. Add keynotes #24, #25, #26, #27, and #28.
 - e. Run refrigerant pipe from DMSCU-1.
 - f. Replace sheet in its entirety.
7. SHEET M201 – MECHANICAL ENLARGED PLAN “MEZZANINE”
 - a. Relocate Motorized Dampers OAU-1.
 - b. Modify ductwork on VAV-1-9 in MECHANICAL 201.
 - c. Replace sheet in its entirety.
8. SHEET M202 – MECHANICAL ENLARGED PLAN
 - a. Relocate EF-9 in COMPRESSOR ROOM 206.
 - b. Replace sheet in its entirety.
9. SHEET M302 –MECHANICAL PIPING DIAGRAM
 - a. Revise piping schematic for the hot water system.
 - b. Replace sheet in its entirety.
10. SHEET M401 – MECHANICAL DETAILS AND LEGENDS
 - a. Add detail #10 EXTERIOR PIPE MOUNTING DETAIL.
 - b. Replace sheet in its entirety.
11. SHEET M500 – MECHANICAL SCHEDULES
 - a. PUMP schedule HWP-1 Change motor horsepower to 3HP.
 - b. PACKAGED AIR COOLED CHILLER schedule add general note #3, and add remark #5.
 - c. UNIT HEATER – ELECTRIC schedule add EUH-3.
 - d. AIR HANDLING UNIT schedule add remark #7 to AHU-1.
 - e. Replace sheet in its entirety.

REISSUED DRAWING SHEETS

SHEET E300 – ELECTRICAL POWER FLOOR PLAN

SHEET M101 –MECHANICAL FLOOR PLAN

SHEET M201 – MECHANICAL ENLARGED PLAN

SHEET M202 – MECHANICAL ENLARGED PLAN

SHEET M302 –MECHANICAL PIPING DIAGRAM

SHEET M401 – MECHANICAL DETAILS AND LEGENDS

SHEET M500 – MECHANICAL SCHEDULES

RESPONSE TO LOW VOLTAGE CONTRACTOR QUESTIONS:

1. What is the current Access Control platform for BISD?
A: Verkada Command VMS
2. What is the current Video Surveillance platform for BISD?
A: Verkada Command VMS
3. If not Genetec, is BISD open to utilizing a unified solution (Genetec)?
A: No, Verkada Command VMS to be the unified Solution.

END OF ADDENDUM #3



SECTION 230933 - BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. Provide and install a complete Building Management and Control System (BMCS), including industrial instrumentation necessary to obtain functions and results specified. A complete system includes items such as sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
- B. Temperature Control System components:
 - 1. Electronic instruments as specified
 - 2. Electric instruments as specified
 - 3. Microcomputer instruments as specified
- C. All control devices of the same type product shall be of a single manufacturer.
- D. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
 - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
 - 1. All components and elements
 - 2. The testing and acceptance procedure
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
 - 1. All components and elements.
 - 2. Start-up and point verification.
 - 3. The testing and acceptance procedure.

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).
 - 1. Temperature control equipment & Field devices.
 - 2. Wiring & Flow diagrams.
 - 3. Sequence of operation.
 - 4. Complete, detailed, control and interlock-wiring diagram.
 - 5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.
 - 6. Submit Input / Output summary of all points.
 - 7. Submit an outline of testing procedures from section Testing and Acceptance.
 - 8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, “Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.
 - 9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 WARRANTY

- A. Provide with a manufacturer’s parts and labor warranty for a period of two years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Automated Logic Branch Office - WebCTRL
- B. Reliable by Unify Energy Solutions

2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.
- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.
- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.
- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure of malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.
- C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.
- D. Network shall support a minimum communications speed of 115.2 Kbps.
- E. The network shall support a minimum of 100 DDC controllers and PC workstations.
- F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.
- G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.
- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
 - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
 - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
 - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
 - 4. Digital outputs - to control two position devices such as starters, actuators, relays,

etc.

- E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
 - 1. Control processes
 - 2. Energy management applications
 - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - 4. Historical/trend data for points specified
 - 5. Maintenance support applications
 - 6. Custom processes
 - 7. Operator I/O
 - 8. Dial-up communications
 - 9. Manual override monitoring
- G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
 - 1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 - 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - 1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 - 2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
 - 3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.

1. Point database
 2. Operator interface
 3. Network communications
 4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.
- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with standard and custom report generation functions that include:
1. Alarm summaries
 2. Motor status summaries
 3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
 4. Program listings
- B. All reports shall be either displayed or printed by:
1. Operator request.
 2. Time of day.
 3. Event conditions (such as in response to an alarm, interlock, etc.).
- C. All reports shall be time and date stamped.
- D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.
- E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.
- F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.
- G. A database and configuration report program shall be provided that allows the user to

interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.

- H. Any invalid operator entry shall result in an error message.
- I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.
- J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

2.7 ENERGY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.
 - 1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
 - 2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
 - 3. A built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.
 - 1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
 - 2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
 - 3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
 - 4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program

- shall revert to its original schedule.
- 5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.

- C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:
 - 1. Enthalpy optimization.
 - 2. Supply air reset.
 - 3. Hot water reset.
 - 4. Chilled water reset.
 - 5. Volumetric control.
 - 6. Dead band control. Install dual set points as requested by user.
 - 7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.

2.8 WEB SERVER ACCESSIBILITY

- A. Industry leading encryption technology to provide accessibility through a web browser.
- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
 - 1. Alarm Display
 - 2. Point Commanding
 - 3. Graphic Display
 - 4. Scheduling
 - 5. Running Reports
 - 6. Point Details

2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
 - 1. Alphanumeric pagers
 - 2. Numeric pagers
 - 3. Email
 - 4. Phones via voice or short message service (SMS)

2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
 - 1. Modules may be mounted remote from the DDCP.
 - 2. Shall communicate with the DDCP over a pair of twisted cables.

2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
 - 1. Variable Air Volume (VAV) boxes

2. Constant Air Volume (CAV) boxes
 3. Dual Duct Terminal Boxes
 4. Unit Conditioners
 5. Heat Pumps
 6. Unit Ventilators
 7. Room Pressurization
 8. Fan Coil Units
- B. Include the following items:
1. All input and outputs necessary to perform the specified control sequences.
 - a. Analog outputs shall be industry standard signals such as 24V floating control.
 2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
 3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
 4. Return to full normal operation without user intervention after a power outage of unlimited duration.
 5. Operation programs shall be field selectable for specific applications.
 6. Specific control strategy requirements, allowing for additional system flexibility.
 7. Controllers that require factory changes of all applications are not acceptable.

2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
1. Spring return to full travel position.
 2. Built in auxiliary switches (motor end switches)
 - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
 3. Minimum torque 60-in-lb
- B. Modulating damper operators:
1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure
 2. Select the operator with available torque to exceed the maximum required operating torque by not less than 100%
 3. Minimum torque 100 in-lb

2.13 ETHERNET CARD

- A. Ethernet Card:
1. Local area network connection interface card.

2.14 CONTROL CABINETS

- A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
1. Powder coat painted on all sides
 2. Cabinet with continuously piano type hinged door
 3. Locking latch
 4. All locks shall use a common key
 5. Devices on the panel face must be identified with engraved nameplates.

6. Panels or termination panels must be identified with engraved nameplates.
7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

2.15 AUTOMATIC CONTROL VALVES

- A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.
- B. Construction:
 1. 2" and smaller:
 - a. Screwed.
 - b. Bodies and internal parts: Bronze, stainless steel or other approved corrosion-resistant metal.
 2. 2-1/2" and larger:
 - a. Flanged.
 - b. Bodies: Cast iron or cast steel.
 - c. Seats and parts exposed to fluid: Bronze, stainless steel or other approved corrosion-resistant metal.
 3. Characterized port ball valves are acceptable for VAV terminal units only.
- C. Modulating straight through water valves: Equal percentage contoured throttling plugs.
- D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.
- E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
 1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
 2. Maximum pressure drop: 5.5 psi.
 3. Relief and bypass valves: Sized according to pressure available.
 4. 2-position valves: Line size.
 5. Manual by-pass operator.
- F. Electronic Actuator:
 1. Direct coupled installation
 2. Visual and electronic stroke indicator
 3. Die-cast aluminum housing
 4. Manual override
 5. Self-lubricating bearing and gear train
 6. Automatic calibration
 7. Automatic duty cycle protection
 8. Overload and stall protection
 9. Non-spring return
 10. Floating /0-10 VAC / 4-20mA operation
 11. UL approved
 12. Provide smooth modulating action and tight close off against the system pressure.
 13. Torque to exceed the maximum required operating torque by not less than 150%.
 14. Actuator input signal shall be compatible with output DDC controller.
 15. Provide weatherproof enclosure (exterior use).
 16. Damper actuators not acceptable for valves.

2.16 FLOW DETECTION SWITCHES

- A. Remote Flow Solid-State Flow Detection:
 - 1. Extended length flow probe
 - 2. Cabinet-mounted control monitor
 - 3. Wetted parts, 316 stainless steel probe
 - 4. Optional temperature and wire-break outputs
 - 5. Flow and temperature switch points
 - 6. LED bar graph display for status indication
- B. Approved Manufacturer:
 - 1. IFM Effector

2.17 DIFFERENTIAL PRESSURE SWITCHES

- A. Wet/wet differential pressure switch
 - 1. Integral Mounting Frame
 - 2. Watertight, dust-tight, and corrosion resistant enclosure.
 - 3. Wetted materials of brass and flouroelastomer.
 - 4. Externally adjustable set point
- B. Approved manufacturer:
 - 1. Square D #9012GGW4
 - 2. Dwyer #DXW-11-153-1
 - 3. Carrier #HK06ZC033

2.18 TEMPERATURE LOW LIMIT SWITCH

- A. Responsive to the coldest 1' section of its length.
 - 1. Double pole single throw switch
 - 2. 20' capillary
 - 3. Line voltage with bellows actuated switch
 - 4. Auto reset for outdoor installation
 - 5. Manual reset for indoor installation

2.19 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
 - 1. Thermister with resistance of 10,000 ohms at 77°F.
 - 2. Accuracy shall be +/-1/2°F.
 - 3. Range of 55° to 95° F.
 - 4. Flush mounted
 - a. Stainless steel flush mount sensor, submit sample for review.
 - 5. Location and height to be approved by Architect/Engineer prior to installation.
- B. Space / Duct Humidity Sensor
 - 1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
 - 2. Capacitance element shall be field replaceable and not require calibration.
 - 3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
 - 4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 - 5. Provide impact resistant Polycarbonate equal to BAPI-Guard covers suitable for

- institutional use. Submit sample for review.
- 6. Provide manufacturers calibration certificate.
- 7. Provide impact resistant Polycarbonate equal to BAPI-Guard guards in the following locations:
 - a. Work Shops
 - b. Equipment/Parts Storage
- C. Duct Temperature Sensors
 - 1. Range of 20° to 120°F.
 - 2. Single point sensing of temperature.
 - 3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
 - 4. Averaging elements of sufficient length to provide accurate, representative indication and control.
 - 5. Averaging elements of sufficient length to prevent variances in temperature or stratification.
- D. Liquid Immersion Temperature Sensors
 - 1. Platinum type resistance temperature detector (RTD).
 - 2. Match sensor range to medium being monitored.
 - a. Hot water range 30° to 250°F.
 - b. Chilled Water 20° to 70°F.
 - 3. Furnish stainless steel wells for installation by Mechanical Contractor.
 - 4. Locate all sensors in field with Owner/Engineer present.
 - 5. System accuracy for liquid temperature sensing shall be +/-1/2°.
 - 6. Sensors must be removable from wells.
- E. Outside Air Temperature and Humidity Sensor
 - 1. Temperature
 - a. Range of -40° to 140°F.
 - b. Accuracy shall be +/-0.9°F
 - c. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.
 - 2. Humidity
 - a. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
 - b. Accuracy shall be +/-2%
 - c. Range from 20 to 95% RH.
 - d. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 - 3. Weatherproof sun shield consisting of multiple white plastic plates to reduce the thermal effects of the sun and increasing air flow between the plates.
 - 4. Sensor shall be mounted a minimum of 6" from all building structures.
 - 5. Minimum of 8' long leads.
 - 6. Provide manufacturers calibration certificate.
 - 7. Provide with a 5-year warranty
 - 8. Manufactured by ACI Model # A/-RH2-AN-O-SUN---NIST

2.20 CURRENT SENSITIVE RELAYS

- A. Ensure compatibility with VFD applications for variable speed motor status.

1. Provide with adjustable set point.
2. Relays must be mounted and not hung by power wires thru CT.
3. Provide split-core type current sensors.
4. Loop powered.
5. LED Status.
6. Acceptable Manufacturer: Veris Industries / Hawkeye
7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.

2.21 DIFFERENTIAL PRESSURE TRANSDUCER

- A. Transducers to convert differential pressures to 4-20 MA analog outputs.
 1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
 2. Factory calibrated and have zero and span trimmers for field calibration.
 3. Range shall be selected to match the medium being monitored.
 4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
 5. LCD Display
 6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

2.22 ELECTRIC REMOTE BULB THERMOSTAT

- A. Two position remote bulb thermostat:
 1. Bimetal controlled.
 2. Sealed mercury switches.
 3. Provide specified control action.
 4. Adjustment can be made by removing unit cover.
 5. Element with capillary length as required for the location.

2.23 ELECTRIC SPACE THERMOSTAT

- A. Two position space thermostat.
 1. Single Pole switch actuated by bi-metal sensing element.
 2. Range shall be 60°F to 90°F.
 3. Removable external knob adjustment means.

2.24 HIGH STATIC PRESSURE SWITCH

- A. With manual reset switch
 1. Approved manufacturer: Cleveland AFS-460.

2.25 INSERTION FLOW SENSORS

- A. Electromagnetic Flow Meter
 1. Retractable hot tap flow sensor
 2. Accuracy: +/- 1% of full scale
 3. Electromagnetic
 4. Custom thread-o-let 400 psi / 250 degree F rated.
 5. Line size from 1-1/4 to 72 inch
 6. Metering range from 0.3 to 15 f/sec.
 7. Remote NEMA 4 wall mounted LCD display

8. Field Pro Software & Communicator
9. Warranty two years
10. Approved Manufacturer Onicon Flow Meter F3500 or FT3500

2.26 CONTROL DAMPERS

- A. Opposed blade dampers.
 1. Frames of 13-gauge galvanized sheet metal.
 2. Provisions for duct mounting.
 3. Damper blades not exceeding 8" in width.
 4. Blades of two sheets of 16-gauge galvanized sheet metal.
 5. Blades suitable for high velocity performance.
 6. Bearings of nylon or oil-impregnated, sintered bronze.
 7. Shafts of 1/2" zinc-plated steel
 8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
 9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
 10. Submit leakage and flow characteristics data with shop drawings.
 11. Linkage shall be concealed out of the air stream within damper frame.
 12. Acceptable Model is Ruskin Model CD60.

2.27 PHOTO-CELL CONTROL

- A. Light Sensitive Resistor.
 1. 4-20 output or switch.
 2. On = 3.0 / fc. Off 10.0 / fc.
 3. UL Approved.

2.28 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps.
 1. Shuts off equipment if water level becomes too high.
 2. DPDT Contacts.

2.29 BY-PASS AUTOMATIC SHUT-OFF TIMERS

- A. Rated at 10 Amps, 125 VAC
 1. Shuts off equipment with timed switch
 2. White decorated timer
 3. Without hold feature
 4. Time Cycle 60 minutes

2.30 CO₂ SENSOR

- A. Telaire Model T5100 CO₂/Temperature Sensor or approved equal
 1. Local visual indication of CO₂ levels in enclosed spaces.
 2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO₂ levels
 3. Bright LED indicator transitions between green, yellow, and red as the CO₂ threshold is exceeded.
 - a. Accuracy: +/- 30 ppm @ 72°F
 - b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

2.31 HVAC SHUTDOWN STATION

- A. Lockdown Switch:
 - 1. Mushroom Red Button within a clear plastic cover
 - 2. Latches when depressed
 - 3. Twist reset
 - 4. Sign "HVAC SHUTDOWN"
 - 5. Manufactured by STI Model #SS2031HV-EN

2.32 AFTER HOURS A/C STATION

- A. After Hours A/C Switch:
 - 1. Yellow Mushroom Button within a clear plastic cover
 - 2. Momentary contact configuration
 - 4. Sign "AFTER HOURS A/C"
 - 5. Manufactured by STI Model # SS2231HV-EN

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The control system shall be installed and final adjustments made by full-time employees of the factory-approved BMCS Building Management Control Subcontractor.
- B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.
- C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore labor allowances should be made for such changes and adjustments if requested.
- D. Points listed within this section are to be connected to the BMCS system as hard-wired points to cards and not connected through BacNet integration. The BacNet interface is for read only points not included within sequences of this specification.

3.2 INTERLOCK AND SAFETY CIRCUITS

- A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
 - 1. The damper and actuators are specified in this section.
 - 2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
 - 3. Provide motorized outside air dampers for the following:
 - a. Supply fans
 - b. AHUs
 - c. Exhaust fans (except kitchen exhaust)
- B. Close the chilled and hot water valves to the coil when the related unit is de-energized.

- C. Interlock each chiller to start its dedicated chilled and condenser water pumps.
 - 1. On shutdown provide a circuit to permit the chilled water pumps and condenser water pumps to run while the chillers pump down as required by the manufacturer.
 - 2. As per manufacturer's recommendations
- D. Primary chilled water control:
 - 1. Operating and safety controls are furnished as an integral part of the water-chilling unit and not specified in this section.
 - 2. Provide a high limit temperature sensor in each primary chilled water pump loop.
- E. Exhaust/Supply Fans:
 - 1. Interlock the related exhaust and supply fans and the related outside air damper.
 - 2. Interlock the exhaust fans with the related air-handling unit through software.
 - 3. Interlock related exhaust fan for dishwasher with time delay off relay.
 - 4. Interlock related exhaust fan for kiln with time delay off relay
 - 5. Interlock kitchen hood related supply and exhaust fans.
 - 6. Provide additional interlocks as indicated on fan schedule and on drawings.
 - 7. Interlock electrical and mechanical room exhaust fans with thermostat.
 - 8. Interlock refrigerant monitor with mechanical room purge system.
 - 9. Interlock science room related supply and exhaust fans.
 - 10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.
- F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor, oil level switch and oil pump on each cooling tower fan.
- G. Freeze Protection:
 - 1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
 - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
 - b. Boilers - Enable during a freeze condition.
 - c. Chillers – Open isolation valves then command by-pass valve to dump water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
 - d. Air Cooled Chillers – Open isolation valves, then enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
 - e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the

outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.

2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.

H. Drain Pan Float Protection:

1. Interlock to shut down unit and close valves.
2. Cooling Coils mounted above ceiling and in roof mounted units.
3. Provide for each cooling coil location.
4. Signal BMCS alarm point

I. Domestic Water System:

1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.

J. Copper Tube Boiler:

1. Interlock each boiler to start its dedicated primary circulating pump. Interlock flow switch and pump to boiler safety terminal strip.
2. On startup enable boiler and primary pump prior to starting secondary system pump until primary loop temperature reaches 105 degrees as per manufacturer's recommendations.
3. Disable secondary pump if boiler goes into alarm or fails to produce heating water within 30 minutes.

K. HVAC Shutdown Station:

1. Provide an emergency mushroom style push / pull station shutdown switch in the Administration Area or as directed by Owner / Architect.
2. Signal the building automation system to de-energize the HVAC equipment.
3. This is to stop exhaust fans and outside air units immediately.
4. Other air handling units, chillers and equipment shall be shut down in an orderly manner so as to not damage the equipment.
5. Once stopped, the system may only be restarted with a key operated switch located adjacent to the shutdown switch.

L. After Hours A/C Station:

1. Provide an momentary style push switch in the Principal's Office or as directed by Owner / Architect.
2. Signal the building automation system to energize the separate DX after hours unit serving the administration and associated sequence of operation.

3.3 GRAPHICS

A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.

1. Modification of existing control systems shall be included.
2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
3. Provide final sequence of operation in written format.

- B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.
- C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.
- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by Owner / Architect.. Obtain a graphic submittal package for review. Construction Drawing room numbers are not to be used unless approved in writing.
- F. Graphics shall clearly display % open from 0-100% on all valves and dampers.
- G. Graphics shall clearly display % run from 0-100% for all VFDs. Displaying current operating hertz only is not acceptable.
- H. System shall include a graphical page that contains building and system related documents stored for ease of remote access.
- I. Contractor shall schedule with district and engineer a graphics review 90 days prior to substantial completion.

3.4 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
 - 1. Wiring of interlock system.
 - 2. Wiring of control instruments.
 - 3. Wiring of control panels.
 - 4. Wiring of related power supplies, i.e. transformers.
 - 5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.

- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.
- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridge rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
- H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.
- I. All wiring associated with building management and control system cover shall be as follows:
 - 1. Sensor jacket color, Green
 - 2. LAN communications, Yellow
 - 3. All THHN wiring shall comply with Division 26 insulation color identification

3.6 EXISTING AUTOMATION SYSTEM

- A. The new system shall be fully integrated with the existing Building Automation System Host server located at the School District maintenance facility. If there is no existing manufacturer's host server a new server shall be included.

3.7 EXHAUST AND SUPPLY FANS

- A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.
- C. Provide by-pass timers/switches for fans indicated in Fan Schedule.

POINT DESCRIPTION	TYPE	DEVICE

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Outside Air Damper	DO	Electronic Operator
Fan Status	DI	Current Sensitive Relay

3.8 MAINTENANCE BAY CO MONITOR AND EXHAUST SYSTEM

- A. Each Maintenance Bay exhaust fan shall be provided with a wall mounted switch and a carbon monoxide monitoring system. The wall switch shall allow users to control fan under normal operation. Upon CO levels rising above setpoint the exhaust fans shall be enabled if not actively operating. Upon exhaust fan activation by either the wall switch or the CO monitor the associated outside air louver motorized damper shall be activated.
- B. This contractor shall wire interlocks from equipment and CO monitor system (provided by BMCS contractor). Provide a sign adjacent to each CO monitor to indicate information about system.
- C. Upon Alarm of CO monitor, notify users via text message.

POINT DESCRIPTION	TYPES	DEVICE
CO Monitor	DI	Control Panel
Control Switch	DI	Switch
Exhaust System Start/Stop	DO	Control Relay
Exhaust Air Damper (Fan)	DO	Electronic Operator
Outside Air Damper (Louver)	DO	Electronic Operator
Exhaust Fan Status	DI	Current Sensitive Relay

3.9 BUILDING ELECTRICAL USAGE

- A. Provide digital monitoring of the building KVA and KWH. Coordinate with the switchgear manufacturer.
- B. Electrical Quality monitoring:
 - 1. Monitor Watts, VA, VAR, Demand, Imbalance, and Power Factor.

3.10 MISCELLANEOUS

- A. Lighting Control:
 - 1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26. This includes but not limited to parking lot lighting, building mounted lighting, canopy lighting and marquee lighting.

2. The contactors for the wall packs, canopy lights, marquee, and parking light pole night lights shall be controlled using both time schedules and sunrise/sunset. The wall packs, canopy lights, marquee, and parking light pole night lights shall be programmed to come on 30 minutes before sunset and go off 30 minutes after sunrise, 7 days a week, based on the longitude and latitude coordinates of the facility to determine sunrise/sunset.. Schedule shall be user adjustable.
3. The contactors for the standard parking light poles shall be controlled using both time schedules and sunrise/sunset. The standard parking light pole lights shall be programmed to come on 30 minutes before sunset and go off at 12 AM then come back on at 5:00 AM and then off again 30 minutes after sunrise. This schedule shall be active Monday through Friday each week and be based on the longitude and latitude coordinates of the facility to determine sunrise/sunset.
4. Between sunrise and sunset, photocell shall override scheduling if ambient light levels fall below set point (adjustable).
5. The points within the BMCS shall be named to match the final PISD approved contactor labels for the type of load and location.
6. Unless otherwise noted on the drawings, provide momentary push buttons to energize exterior lighting for a preprogrammed length of time.
 - a. Provide separate control of each contactor.

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Contactor
Momentary Control Switch	DI	Switch

- B. Photocell: Provide a photocell mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

- D. Outside Air: Provide a temperature sensor and a humidity sensor to monitor outside air conditions.

POINT DESCRIPTION	TYPE	DEVICE
Outside Temperature	AI	Thermistor
Outside Humidity	AI	Humidity Sensor

- E. Temperature Sensor: Provide a temperature sensor in each MDF and IDF rooms to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Sensor

3.11 FAN POWERED TERMINAL UNIT COORDINATION

- A. Equipment furnished in this section and installed by Section 23 36 16:
 - 1. Automatic temperature control card (DDC).
 - 2. Damper Actuator
- B. Equipment furnished and installed by Section 23 36 16:
 - 1. Damper.
 - 2. Multi-point flow sensor.
 - 3. Power transformer.
 - 4. Controller enclosure.

3.12 SINGLE ZONE VARIABLE AIR VOLUME AIR HANDLING UNIT (AHU-2, AHU-3)

- A. This unit is furnished with a chilled water cooling coil, a hot water reheat coil, and a variable frequency drive. Control shall be as follows:
 - 1. A room Thermistor sensing space temperature through the Direct Digital Control Panel shall vary the speed of the fan to maintain room setpoint. The air volume of the fan can range from 100% to 30% (adjustable) of the air quantity specified or to the outside air percentage whichever value is larger. A chilled water coil leaving air temperature sensor through the Direct Digital Control Panel shall modulate the cooling coil control valve to maintain the leaving air temperature as scheduled. When the fan is at minimum speed of its specified air quantity and the room temperature is below the room setpoint, the room Thermistor shall modulate the valve on the cooling coil and the valve on the hot water coil in sequence to maintain the desired space temperature. A room humidity sensor shall override the operation of the cooling coil control valve to maintain the relative humidity setpoint in the space. The room temperature sensor shall modulate the hot water reheat coil control valve to maintain the space temperature. The dehumidification sequence only applies after the fan has reached the minimum fan speed.
- B. Outside air for these units are being provided pretreated from a separate Outside Air Unit via an Outside Air Variable Air Volume Terminal Unit.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Air Flow Sensing Switch
Fan Speed	AO	Variable Frequency Drive
Space Temperature	AI	Space Thermistor
Space Humidity	AI	Humidity Sensor
CHW Valve	AO (1)	Electronic Operator

POINT DESCRIPTION	TYPES	DEVICE
Reheat HW Valve	AO (1)	Electronic Operator
Cooling Coil Leaving Air Temp.	AI	Averaging Sensor
Discharge Air Temperature	AI	Duct Thermistor

3.13 VARIABLE VOLUME AIR HANDLING UNITS (AHU-1)

- A. Units consist of a chilled water coil, a fan, a variable speed drive, and outside air fan.
- B. The unit shall be started and stopped from the BMCS system.
- C. Discharge air temperature control:
 - 1. A sensor far enough from the fan discharge to be truly representative of the average temperature shall modulate the valve on the cooling coil to maintain setpoint. Reference drawing schedule for discharge temperature.
- D. Variable air volume control:
 - 1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
 - 2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 - a. Transmit a signal to the supply fan motor speed controller.
 - b. Modulate the fan speed to maintain the desired static pressure.
 - c. Coordinate signal with the fan motor speed controller.
 - 3. Install a static pressure high limit safety device to de-energize the system.
 - a. Manual reset.
- C. Outside air for these units are being provided pretreated from a separate Outside Air Unit via an Outside Air Variable Air Volume Terminal Unit during central plant operations.
- D. After Hours DX A/C
 - 1. Each unit is provided with an auxiliary DX coil and Air Cooled Condensing Unit with a variable capacity compressor. Control shall be as follows:
 - a. This sequence shall only be permitted to operate when the central plant is deactivated.
 - b. Upon activation of the AFTER HOURS A/C push button located in the principals office, the BMCS shall energize the air cooled condensing unit to stage and modulate to provide the leaving air temperature as scheduled. During the operation of the DX system, safeties shall be provided to restrict air handling units airflow from being reduced below the minimum required face velocity of DX coil per manufacturers recommendations. The terminal units airflow sum shall also be restricted from reducing below this set value.
 - c. During After Hours operation the OAU shall not operate but instead the OA SF and OA damper shall operate and open to provide OA.
- E. After Hours Outside Air control:

1. The outside air for after hours operation shall be provided through the OAU. The OA shall be unconditioned from the OAU as chilled water system will be disabled.
2. This operation shall only occur upon activation of the AFTER HOURS A/C push button located as indicated on the drawings.
3. Provide a temperature low limit switch located on the discharge side of the preheating unit to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 37°F. Device shall be manual reset.
4. During warm-up and cool-down periods (optimum start/stop), the outside air fans shall not be activated. During occupied times, the fans shall be activated.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Discharge Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Outside Air Temperature	AI	Duct Thermistor
Duct Static Pressure	AI	Static Pressure Sensor
Variable Speed Fan	AO	Motor Controller
Freeze Status	DI	Temperature Low Limit Switch

3.14 CONSTANT VOLUME / VARIABLE VOLUME TERMINAL UNITS

- A. Each unit shall consist of a pressure independent variable volume damper, and a hot water heating coil. The terminals shall be interlocked with the AHU fan. Terminal units shall be opened prior to AHU fan being enabled. Controls shall be as follows:
1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper from full open to a minimum airflow rate to maintain room setpoint. If heating is required, the temperature sensor shall modulate the hot water control valve to maintain room setpoint with the variable volume damper in the minimum airflow position.
 2. Control valve, and control valve operator are specified in this section.
 3. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, damper position, and hot water valve position.

POINT DESCRIPTION	TYPES	DEVICE

POINT DESCRIPTION	TYPES	DEVICE
Space Temperature	AI	Space Thermistor
Primary Air	AO	Variable Volume Damper Operator
HW Valve	AO	Electronic Operator
Start/Stop	DO	Control Relay
Discharge Temperature	AI	Duct Sensor

3.15 VARIABLE AIR VOLUME OUTSIDE AIR HANDLING UNIT (OAU-1)

- A. Each unit shall consist of a supply air fan, hot water preheat coil and chilled water coil.
- B. BMCS shall enable unit operation and open outside air damper. Interlock OAU operation with the related air handling units.
- C. Variable air volume control:
 1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
 2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 - a. Transmit a signal to the supply fan motor speed controller.
 - b. Modulate the fan speed to maintain the desired static pressure.
 - c. Coordinate signal with the fan motor speed controller.
 3. Install a static pressure high limit safety device to de-energize the system.
 - a. Manual reset.
- D. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
 1. Transmit a 4-20 MA signal to the supply fan motor speed controller.
 2. Modulate the supply fan speed to maintain the desired static pressure. The exhaust fan shall maintain constant as the VFD is for soft start only.
 3. Coordinate with the fan motor speed controller specified in another section.
 4. Install a static pressure high limit safety device to de-energize the system.
 - a. Manual reset.

POINT DESCRIPTION	TYPE	DEVICE
Start/Stop	DO	Control Relay
Supply Fan Status	DI	Current Sensitive Relay
Supply Fan Variable Speed Motor	AO	Motor Controller

POINT DESCRIPTION	TYPE	DEVICE
Differential Across Filters	DI	High / Low limit Switch
OA Dampers	DO	Control Relay
Static Pressure	AI	Static Pressure Sensor
CHW Valve	AO	Electronic Operator
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
HW Valve	AO	Electronic Operator
Static Pressure High Limit	DI	Static Pressure Switch
Freeze Status	DI	Temperature Low Limit Switch

3.16 OUTSIDE AIR VARIABLE VOLUME TERMINAL UNITS

- A. Each unit shall consist of a pressure independent variable volume damper. The terminal unit's damper shall be interlocked with the associated OAHU supply fan.
1. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position. This information shall be displayed on the terminal unit graphics page.
 2. A space CO2 sensor associated with the AHU being served by the OAVAV terminal unit shall provide input to the central BMCS controller. The BMCS shall monitor CO2 levels of the zones served by the associated air handling unit and modulate the pretreated outside air damper to maintain set point 600 PPM (adjustable). This feature shall be user selectable on the AHU graphic page.
 3. Terminal units serving Variable Volume Air Handling Units shall not be provided with CO2 control. These unit shall modulate to maintain the scheduled OA CFM during all occupied times.

POINT DESCRIPTION	TYPES	DEVICE
Primary Air	AO	Variable Volume Damper Operator
Discharge Air Temperature	AI	Duct Thermistor
CO2 Concentration	AI	CO2 Sensor

3.17 INFRARED HEATERS

- A. The Maintenance Bays are being provided with multiple gas fired infrared heaters. The heaters are controlled locally with switches however the BMCS shall schedule operation.

3.18 OSCILLATING FANS

- A. This contractor shall provide and install all wiring associated with the oscillating fans and controllers. This includes but not limited to CAT cables and low voltage wiring for controllers and fans. Installation shall be in accordance with manufacturer's installation requirements.
- B. The new oscillating fans are being provided with wall mounted controllers that are equipped with BacNET MS/TP connectivity. While controllers are equipped with BacNET, the BMCS shall not interface or controls fan controllers.

3.19 ELECTRIC UNIT HEATERS

- A. An electric thermostat shall activate the unit and stage the electric coil to maintain room setpoint.

3.20 CHILLED WATER COOLING SYSTEM

- A. Systems consist of a single packaged air-cooled chiller with dedicated chilled water pump.
- B. Whenever there is a call for cooling in the system energize the system.
- C. Reference interlock and safety circuits for interlocks and shut down.
- D. Provide interface to each chiller through the chiller BacNet interface card. Provide a graphic page for the interface card that displays all values available.

POINT DESCRIPTION	TYPE	DEVICE
Chiller Start/Stop	DO	Control Relay
Chiller Status	DI	Safety Alarm Relay
Pump Start/Stop	DO	Control Relay
Pump Status	DI	Current Sensitive Relay
Building Supply/Return	AI	Temperature Sensors

3.21 HYDRONIC HOT WATER HEATING SYSTEM

- A. This system consists of one non-condensing hot water boiler with constant flow primary boiler pump and variable flow hot water secondary pump. Control of the hydronic hot water heating system is as follows:
 - 1. Energize the hydronic hot water heating system whenever there is a call for heating in the building.

- a. Monitor all control valves to determine if a heating requirement exists.
2. Energize the hybrid sequence controller specified elsewhere.
 - a. The hybrid sequence controller shall control all functions and sequencing of the hot water heating boilers.
 - b. Connect all boilers to the master boiler controller specified elsewhere with communication cable as required.
3. Hydronic hot water heating system supply temperature reset:
 - a. A temperature sensor sensing outdoor temperature shall provide an input to the hybrid sequence controller to reset the hot water supply temperature.
 - 1) Maintain 180°F (adjustable) supply water temperature whenever the ambient temperature is 20°F and below.
 - 2) Maintain 140°F (adjustable) supply water temperature whenever the ambient temperature is 60°F and above.
 - 3) All reset temperatures shall be adjustable through the BMCS.
4. Secondary hot water pump control:
 - a. A system differential pressure sensor shall modulate the hot water pump variable frequency drives and stage pumps A and B to maintain system differential pressure.
 - b. This system shall be completely adjustable in the field.

POINT DESCRIPTION	TYPES	DEVICE
Hybrid Sequence Controller	DO	Control Relay
Boiler Alarm Status	DI	Safety Relay (Each Boiler)
Secondary Hot Water Pump Start/Stop/Modulation	AO	Variable Frequency Drive (Each Pump)
Pump Status	DI	Current Sensitive Relay
Building Hot Water Supply/Return Temperature	AI	Pipe RTD
Boiler Discharge Water Temp.	AI	Pipe RTD (Each Boiler)
Ambient Temperature	AI	Thermistor
Hot Water Mixing Valve	AO	Electronic Operator
System Differential Pressure	AI	Pressure Sensor
Boiler Supply Water Reset	AO	Hybrid Sequence Controller
Inlet Temperature (Read Only)		Bacnet Card (Each Boiler)
Outlet Temperature (Read Only)		Bacnet Card (Each Boiler)
Header Temperature (Read Only)		Bacnet Card (Each Boiler)

POINT DESCRIPTION	TYPES	DEVICE
Boiler State (Read Only)		Bacnet Card (Each Boiler)
Error Code (Read Only)		Bacnet Card (Each Boiler)

3.22 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
1. Field panel checkout:
 - a. Verify enclosure is not mounted on vibrating surface.
 - b. Verify class I and class II wiring is separated within enclosure.
 - c. Check for shorts/grounds/induced voltages/proper voltages.
 - d. Verify proper point terminations in accordance with as-builts.
 - e. Verify that all modules are in proper place and addressed.
 - f. Verify proper power voltage.
 - g. Load database and programming.
 - h. Startup the panel.
 - i. Point and device checkout.
 2. Analog input point checkout:
 - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
 - b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
 - c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
 - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
 - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
 - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
 3. Digital input point checkout:
 - a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
 - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
 - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
 - d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.

- e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
- 4. Digital output point checkout:
 - a. Verify that device is correctly wired and terminated as shown in the design documentation package.
 - b. Verify that the correct voltage is utilized in the circuit.
 - c. Verify the point database to be correct (i.e. point name, address, etc.).
 - d. Check and verify that the end device responds appropriately to the digital output(s).
 - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
 - f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
 - g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
- 5. Analog output point checkout:
 - a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
 - b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
 - c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
 - d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
 - e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
 - f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
 - g. After verifying the set-up and operation of any associated equipment

- check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
- h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.
6. Terminal equipment controller checkout:
- a. Load program database
 - b. Enable programs
 - c. Verify sequence of operations
7. Programming checkout:
- a. Provide checkout for each system and sequence of operation.
 - b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to meet your specific requirements.
 - c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
 - d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
 - e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
 - f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.
8. Workstation checkout:
- a. Verify the operation of all trunk interface equipment.
 - b. Verify all workstation software, including options, based upon the installation instructions for the PC.
 - c. Perform software backup (site, options, etc.)
 - d. Complete workstation configuration report for owner signoff.
 - e. Provide verification that all graphics have been created, as required by project bid documents.

3.23 TESTING AND ACCEPTANCE

- A. General:
- 1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
 - a. Follow in the order specified.
 - b. Each testing phase shall be satisfactorily completed before entering the next phase.
 - 2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.
 - 3. Submit for approval, a sample of the form on which the test will be reported.
 - a. Identify project.

- b. Provide a list of all points, arrange in numerical order of point addresses.
 - 1) Show point descriptor and location of each.
 - 2) Indicate DDC panel that processes each point.
 - 3) Use the list as a basis for the specified report form.
 - c. Signatures of participants and observers.
 - d. Results.
 - e. Description of adjustment or corrections of points in error.
 - f. Date.
 4. Provide schedule of tests. Estimate dates of significant events.
 5. Test, calibrate and adjust each point in the system as specified.
 6. Provide documentation of all tests and verifications as specified.
 7. Provide trend reports indicating proper control of all points for an extended period of time.
- B. Phase 1 - Testing, Calibrating, and Adjusting:
 1. Operate each analog point in the entire system.
 - a. At a point in the upper quarter of its range.
 - b. At a point in the lower quarter of its range.
 - c. At its operating point.
 2. Provide personnel and diagnostic instruments at both the central and remote locations.
 3. Provide testing stimulants for alarms.
 4. Use digital meters of double the accuracy of the instruments being calibrated.
 5. Provide an approved test device for simulating high and low temperatures.
 6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
 7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
 8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
 9. Test all power transducers with a Dranetz Power Analyzer.
- C. Phase 2 - Equipment and Point Verification:
 1. Verify calibration or function of each point.
 - a. Verify analog points at operating value.
 - b. Record on specified form.
 - c. Make approved adjustments to out of tolerance points.
 - 1) Identify these points for ready reference.
 2. After verification procedure in completed:
 - a. Verify corrected points.
 - b. Record on specified form.
 - c. Points requiring correction.
 - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.
- D. Phase 3 - Software Verification:
 1. Submit agenda and report format for software demonstrations.
 2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
 3. Demonstrate compliance with response time specifications.
 - a. Simulate normal heavy load conditions.

- b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
 - 04. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.
- E. Provide the following reports to Engineer at final completion of all Testing:
 - 1. List of all points.
 - 2. List of all points currently in alarm.
 - 3. List of all disabled points.
 - 4. List of all points in over-ride status.
 - 5. List of all points currently locked out.
 - 6. List of user accounts and access levels.
 - 7. List all weekly schedules.
 - 8. List of holiday programming schedules.
 - 9. List of limits and deadbands.
 - 10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
 - 11. List of programs.
 - 12. Provide trend data reports to ensure proper operation and sequence control of BMCS.
- F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.24 TRAINING

- A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.
- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
 - Explanation of drawings, operations and maintenance manuals
 - Walk-through of the job to locate control components
 - Operator workstation and peripherals
 - DDC controller and ASC operation/function
 - Operator control functions including graphic generation and field panel programming
 - Operation of portable operator's terminal
 - Explanation of adjustment, calibration and replacement procedures
 - Student binder with training modules
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.25 PROJECT MANAGEMENT

- A. Provide a designated project manager who will be responsible for the following:
 - 1. Construct and maintain project schedule.

2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
3. Attend project meetings as necessary to avoid conflict and delays.
4. Make necessary field decisions relating to this section.
5. Coordination / Single point contact.
6. Have Internet access for project management.

END OF SECTION

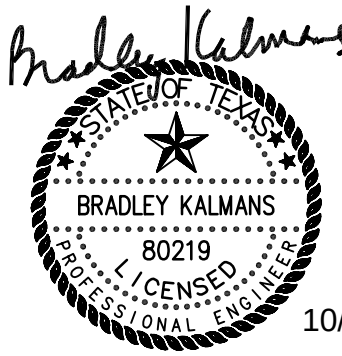
Bradley Kalmans



10/23/2024

SECTION 233113 - DUCTWORK

PART 1 - GENERAL



10/23/2024

1.1 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

- A. Division 23 Mechanical
 - 1. Air Devices
 - 2. Air Handling Units
 - 3. Insulation
 - 4. Terminal Units
 - 5. Fans
 - 6. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
 - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
 - 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.4 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.
- B. Submit product data and sealing materials to be used.
- C. Submit sound attenuation data.
- D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

- A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.
- B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.
- C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
 - 1. Galvanized
- D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.
- E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.
- F. Shower Area Exhaust Systems: Welded 304 Stainless steel.
- G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge
- H. Natatorium Ductwork: 304 Stainless Steel

2.3 ACOUSTICAL DUCT

- A. Duct and fittings:
 - 1. Double wall acoustically treated.

2. Annular space packed with fiberglass insulation.
3. Perforated metal liner to provide specific acoustic impedance
4. Insulation 1.0 pcf. 1 inch thick
5. United McGill Acousti-K27 spiral lockseam or approved equal
6. Material as indicated below:
 - a. Paintable Galvanized Steel

- B. Pressure rating and tests as specified for single wall ductwork.

2.4 DUCT SEALING OF SEAMS AND JOINTS

- A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
1. Indoor applications – Foster 32-14
 2. Outdoor applications – Foster 32-17

2.5 FLEXIBLE DUCT LOW PRESSURE

- A. Construction:
1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
 - a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
 2. UL 181 Class I air duct label
 3. Reinforced vapor barrier jacket
 4. Rated for use at system pressure (6" wc minimum)
 5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.
- B. Fire hazard classification:
1. Flame spread rating 25 maximum.
 2. Smoke developed rating 50 maximum.
- C. Thermal characteristics:
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 3. 2" minimum wall thickness insulation with 1" overlap
- D. Acceptable manufacturers:
1. Flexmaster
 2. Hart & Cooley
 3. Omniair
 4. Peppertree Air Solutions

2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

- A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel

helix without the use of adhesives.

- B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:
Positive: 12" w.g.
Negative: 5" w.g.
- C. The duct shall be rated for a velocity of at least 5500 fpm.
- D. Suitable for operating temperature range of -20°F to +250°F.
- E. Factory insulate the flexible duct with fiberglass insulation.
 - 1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
 - 2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
 - 3. 2" minimum wall thickness insulation with 1" overlap
- F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.
- G. Acceptable manufacturers:
 - 1. Flexmaster
 - 2. Omniair
 - 3. Peppertree Air Solutions

2.7 FIRE DAMPERS

- A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.
- B. Acceptable Manufacturers:
 - 1. Ruskin
 - 2. Prefco Products
 - 3. Air Balance
 - 4. Greenheck, Inc.
 - 5. Nailor Industries
 - 6. Pottoroff

2.8 CEILING RADIATION DAMPERS

- A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral

Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.

- B. Acceptable Manufacturers
 - 1. Ruskin
 - 2. Prefco
 - 3. Air Balance
 - 4. Phillips
 - 5. Safe-Air
 - 6. Nailor Industries

2.9 WALL LOUVERS

- A. Refer to schedule on drawings. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
- D. Louvers shall be AMCA-550 tested and approved.
- E. Acceptable manufacturers:
 - 1. American Warming and Ventilation
 - 2. Arrow
 - 3. Greenheck
 - 4. NCA
 - 5. Pottorff
 - 6. Ruskin

2.10 FLUES FOR POWER EXHAUST AND HIGH EFFICIENCY BOILERS AND WATER HEATERS

- A. Double wall air insulated positive pressure chimney equal to Metalbestos, Van-Packer, Schebler or Metal-Fab. Chimney shall be rated for 550°F maximum flue gas temperature and with a UL tested pressure rating of 40 inches w.c. The interior pipe shall be constructed of AL 29-4C stainless steel and the exterior pipe shall be constructed of 304 stainless steel. Stack system shall be complete with a one inch air gap between inner liner and outer cover. Chimney shall be constructed and installed per UL-1738 and NFPA-211. All accessories shall be made by the same manufacturer and designed to be a part of a positive pressure chimney system.

2.11 DUCT LINING

- A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.12 VOLUME DAMPERS

- A. Manual balancing dampers that meet or exceed the following minimum construction standards:
 - 1. Frame 16-gauge
 - 2. Blades 16-gauge
 - 3. Bearings corrosion resistant
 - 4. Concealed linkage
 - 5. Opposed blade dampers
- B. Acceptable manufacturer:
 - 1. Ruskin Model MD-35 or approved equal, by
 - 2. Arrow
 - 3. American Warming and Ventilating
 - 4. Nailor Industries
 - 5. Pottoroff

2.13 ACCESS DOORS

- A. Round spin-in door of galvanized steel.
 - 1. Fire proof sealing gaskets and quick fastening locking devices
 - 2. Insulated door
 - 3. Conform to the requirements of the NFPA
 - 4. Identification and use of each access door
 - 5. UL label to match the construction in which it is installed
 - 6. Cable attached to door and outer frame
 - 7. Low leakage Access Door
- B. Acceptable Manufacturer
 - 1. Flex master, Inspector Series
 - 2. Approved Equal

2.14 COMBINATION FIRE/SMOKE DAMPERS

- A. Combination fire/smoke dampers meeting the following requirements:
 - 1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
 - 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
 - 3. As part of the UL qualification, dampers shall have demonstrated a capacity to

operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.

4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
5. Provide UL555S qualified electric actuator at 120 VAC.
6. Provide air-foil type blades.

B. Provide integral sleeves

C. Acceptable Manufacturers:

1. Ruskin
2. Air Balance, Inc.
3. Greenheck, Inc.
4. Nailor Industries
5. Pottoroff

2.15 SMOKE DAMPERS

A. Smoke dampers meeting the following requirements.

1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
4. Provide UL555S qualified electric actuator at 120 VAC.
5. Provide air-foil type blades.

B. Provide integral sleeves.

- C. Acceptable Manufacturers:
 - 1. Ruskin
 - 2. Air Balance, Inc.
 - 3. Greenheck, Inc.
 - 4. Nailor Industries
 - 5. Pottoroff

2.16 DIFFUSER FITTINGS LOW PRESSURE TAPS

- A. Fitting shall meet or exceed the following minimum construction standards:
 - 1. Conical with a base diameter two inches larger than the tap diameter.
 - 2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
 - a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
 - b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
 - c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
 - 3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
 - a. Through 8 inches: 26 gauge; Damper blade 22 gauge
 - b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
 - c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
 - d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
 - 4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
 - 5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
 - 6. Provide the damper with a self-locking regulator and handle.
 - 7. Provide a 2" sheet metal stand-off to extend the regulator.
 - 8. Flex duct grip area – 2 inches behind retaining bead
 - 9. Flex duct retaining bead – 1 inch from end
 - 10. Conical length of at least 3 inches
 - 11. Barrel length of at least 9 inches

2.17 AUXILIARY DRAIN PANS

- A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

2.18 DUCTWORK SUPPORTS ON ROOF

- A. Support ductwork on roof with Portable Pipe Hanger Model PHP-D fully adjustable height and width. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized framing. Nuts and washers shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
- H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
- I. Install end bearing at all location where damper shaft penetrates duct wall.
- J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.

- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
 - 1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
 - 2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.
- E. Use pushrod operator with locking nut and butt hinges assembly.
- F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
 - 1. Return air ductwork
 - 2. Outside air branch duct
 - 3. Exhaust branch duct
 - 4. Exhaust connections to hoods except kitchen grease hoods or equipment
 - 5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
 - 6. At each outside air and return air duct connection to plenum of constant volume units
 - 7. At discharge side of constant volume boxes
 - 8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
 - 9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.
- G. Elbows:
 - 1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
 - 2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.
- H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.
- I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.
- J. Insulated Flexible Duct:
 - 1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet

metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.

2. Construct bends over 45° with sheet metal elbows.

K. Duct Supports:

1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

- L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

3.3 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil

each door for specific use. Install access doors in each of the following locations:

1. Fire Dampers
 2. Smoke Dampers
 3. Smoke/fire Dampers
 4. Outside Air Dampers
 5. Duct Mounted Coils (up-stream)
 6. Control Dampers
- B. Size access door 1" smaller than ductwork.
1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.6 DUCT LINING

- A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
- B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.
- C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.
- D. Do not install liner in multi-zone unit ductwork.

3.7 SEALING OF SEAMS AND JOINTS

- A. Seal supply, return, exhaust and outside air duct systems.

3.8 FLUES

- A. Provide and install flues for all gas fired equipment.
- B. Refer to plans for all related locations.
- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.
- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.
- E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 DISHWASHER HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the washer.

3.10 SHOWER AREA EXHAUST SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot slope down to grille connection. Install in accordance with Fig. 2-21 of SMACNA HVAC Duct Construction Standards.

3.11 KITCHEN EXHAUST DUCT

- A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

3.12 FUME HOOD EXHAUST SYSTEM

- A. All material and fittings shall be 304 stainless steel construction.

3.13 ACOUSTICAL DUCT

- A. Install in the following locations:
 - 1. Where indicated on the drawings.

3.14 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

3.15 CONNECTIONS TO LOUVERS

- A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.

- B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.16 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross braced and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.
- B. Provide access doors.

3.17 AUXILIARY DRAIN PANS

- A. Where coils that have a condensate drain are located above ceiling.

3.18 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.
- D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

3.19 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

- A. As the project progresses, test the ductwork in sections.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Finally as a complete system, test ductwork at a minimum of 2.5" with a maximum allowable leakage of 1% of the total design supply airflow.
- D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION

SECTION 271000 - STRUCTURED CABLING SYSTEM (SCS)

PART 1. GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section, including any associated drawings:
1. Conditions of the Contract
 2. Division 1
 3. Division 26
 4. Division 27
 5. Division 28.

1.2 DESCRIPTION

- A. Summary of Work:
1. Provide a complete and tested Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay cabinets/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/EIA/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
 2. An IDF will be required when the distance between outlet termination classrooms and MDF/IDF exceeds 280', including service loops. IDF's shall be selected and organized to be minimum in number while still reaching all locations to be wired.
 3. If there are any discrepancies between the drawings and specification or among themselves, the Contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the Contractor shall provide pricing for the most costly scenario and obtain clarification during the course of the project.
 4. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.
 5. This project consists of the provision and installation of a Structured Cabling System (SCS) to furnish a Network Cabling Infrastructure as required to support network connectivity to workstations, telephones, video surveillance, access control, building automation, electrical lighting, and any other system requiring network connectivity.
 6. The work includes provision and installation of a complete Cabling System (SCS) in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both

- pre-proposal and during the project
7. The SCS Installer shall comply with all conditions of the contract and “Division 1 –General Requirements” as they apply to the SCS Scope of Work. It shall be the responsibility of the SCS Contractor to make themselves familiar with all documents.
 8. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the SCS installer, unless specifically stated otherwise.
 9. SCS contractor to provide network drops for all locations shown on the drawings, plus:
 - a. Communications System
 1. IP Speakers
 2. Controllers/Headend
 3. Administration Station
 - b. Video Surveillance System
 1. Local storage server
 2. IP Video Surveillance Cameras
 - c. Access Control System
 1. Controllers
 2. Doors

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required. The Contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the project.
 2. The approved manufacturers shall provide a complete End-to-End solution with the maximum product and performance warranty offered by the specified manufacturer.
 3. Manufacturer substitution approval request must be submitted in compliance with the Division 1 instructions and must be received no less than ten (10) business days prior to the posted proposal submission date. No substitutions will be allowed if not submitted per these instructions and approved via official pre-bid addendum.
- B. Installer Qualifications:
 1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Structure Cabling System installations.
 2. The SCS Installer shall be a Certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The Contractor's certification must have been obtained and held within 75 miles of the project's location.
 3. The installing Contractor must have a full-time employed RCDD (Registered

- Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.
4. All individuals installing the SCS must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the Contractor's product submittals.
 5. The proposing Contractor and the installing Contractor must be the same company. No sub-contractor to the proposing SCS Contractor will be allowed for any portion of the SCS scope of work.
- C. Low Voltage Meeting Requirements:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.
 2. The successful Contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other Contractors.
 3. Prior to the installation of any items required for this scope of work the Contractor must provide a purchase order with a detailed material list for all materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.
- D. Acceptance:
1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.
- E. Warranty:
1. The selected system installer shall be a certified installing Contractor of product and hold current certification. Contractor shall provide a 15-year end-to-end performance warranty on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL cable links have been tested bi-directionally (end to end) using a Level 2 or better tester, per TSB-67, and that all test results conform to the most current TIA/EIA-568-A and/or TSB-67 Link values.
 2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B.
 3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ISO/IEC 11801, ANSI/TIA/EIA-568-A, or EN 50173. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.3 REGULATORY REQUIREMENTS

- A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments

2. National Electrical Code, current version
- B. Other References:
1. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises...
 2. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
 3. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
 4. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard
 5. ANSI/TIA-568-C.4, Coaxial Cabling Component Standard
 6. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
 7. ANSI/TIA-492-AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition
 8. ANSI/ICEA S-83-596, Fiber Optic Premises Distribution Cable.
 9. ANSI/TIA/EIA-598, Color Coding of Optical Fiber Cables
 10. ANSI/ICEA S-87-640, Fiber Optic Outside Plant Distribution Cable.
 11. ANSI/TIA/EIA-758: Customer-Owned Outside Plant Telecommunications Cabling Standard.
 12. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Single mode Fiber Plant: OFSTP-7.
 13. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Plant: OFSTP-14A
 14. ANSI/TIA/EIA-TSB-125, Guidelines for Maintaining Optical Fiber Polarity Through Reverse-Pair Positioning
 15. ANSI/TIA/EIA-TSB-140, Additional Guidelines for Field Testing Length, Loss, and Polarity of Optical Fiber Cabling Systems.
 16. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure
 17. TIA/EIA-607-B - 2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications
 18. Institute of Electrical and Electronic Engineers (IEEE 802.xLAN)
 19. TIA/EIA 942 Data Center Standards
 20. TIA/EIA TSB40
 21. Current BICSI Telecommunications Distribution Methods Manual
 22. NFPA 70 – National Electrical Code (NEC).
 23. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM).
- C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements

1.4 ABBREVIATIONS

- A. The following abbreviations are used in this document:
- | | |
|-----|---------------------------------|
| IDF | Intermediate Distribution Frame |
| MDF | Main Distribution Frame |
| UTP | Unshielded Twisted Pair |

STP Shielded Twisted Pair
SCS Structured Cabling System
RCDD Registered Communications Distribution Designer

1.5 SUBMITTALS

- A. Project Initiation: Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 2. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided.
 3. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 4. Testing: Proposed Contractor UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.
 5. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 6. Each Submittal must have a detailed parts list with quantities.
 7. Certifications: The Contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
 - a. BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
 - b. Certifications must be obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not and individual certification.
 - c. Certifications must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
 - d. Fiber Optic Technician Certification: This certification must be held by the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and testing.
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
1. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current. Identifiable, separate routing shall be shown for both

- the station cabling and the MDF-to-IDF tie cabling.
2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general Contractor:
 - a. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - b. Location of sleeved wall pass-thru
 - c. Size of sleeve at each location installed
 - d. Quantity of cable passing through each sleeve
 - e. Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
 - f. Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
 3. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
 4. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.
- C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.
- D. Close-out Procedures: Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
 3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
 5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and

- conductor size, quantity, and color in each raceway.
7. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using Revit CAD. Provide the Owner with electronic versions of the as-builts on CD media.
 8. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
 9. A copy of the manufacturer's warranty on the installed system.
 10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
 11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
 12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.
 13. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation with final graphic numbering. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF).

PART 2 – PRODUCTS

2.1 GENERAL

- A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.
- B. Materials: Materials shall be as listed.
- C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.
- D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:
 - CM Communications Cable
 - CMP Plenum Rated Communications Cable
 - CMR Riser-Rated Communications Cable
- E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet

specifications shall not be used in the installation.

- F. Cable Lubricants:
 - 1. Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.
- G. Fire Wall Sealant:
 - 1. Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.

2.2 APPROVED MANUFACTURERS

- A. Copper Channel
 - 1. Data/Voice, Wireless AP Cables
 - a. Panduit
 - b. CommScope
 - c. ~~Owner approved manufacturers~~ Leviton/Berk-Tek
 - 2. Jacks, Patch Panels
 - a. Panduit
 - b. CommScope
 - c. Legrand
 - d. ~~Owner approved manufacturers~~ Leviton/Berk-Tek
- B. Fiber Channel
 - 1. Panduit
 - 2. CommScope
 - 3. ~~Owner approved manufacturers~~ Leviton/Berk-Tek
- C. Data/Ladder Racks, Grounding, Wire Management
 - 1. Panduit
 - 2. CommScope
 - 3. Chatsworth
 - 4. Legrand
 - 5. Owner approved manufacturers
- D. PoE Surge Protection for exterior devices
 - 1. Ditek
- E. Fire Wall Sealant
 - 1. 3M or pre-approved equal

2.3 MATERIALS

- A. Horizontal Cabling
 - 1. Category 6, 4P, 23 AWG, CMP
 - 2. Refer to PART 3 – EXECUTION for colors
- B. Patch Panels – Copper
 - 1. 24/48 Port
 - 2. Rack Mount
 - 3. Flat
 - 4. Modular

- 5. Rear cable management bars
- C. Data Jacks
 - 1. Category 6
 - 2. Modular
 - 3. Refer to PART 3 – EXECUTION for colors
- D. Faceplates
 - 1. Single gang
 - 2. Minimum 4-port
 - 3. Coordinate color with owner and division 26.
- E. Patch Cords/Station Cables – Copper
 - 1. Category 6
 - 2. Factory terminated
 - 3. Refer to PART 3 – EXECUTION for colors
 - 4. Refer to PART 3 – EXECUTION for lengths
- F. Backbone Cabling – Copper
 - 1. Category 6, 4P, 23 AWG, CMP
- G. Backbone Cabling – Fiber
 - 1. Multimode, OM3
 - 2. 12-strand
 - 3. Plenum rated
 - 4. Armored
- H. Patch Panels – Fiber
 - 1. Modular
 - 2. Rack mounted
- I. Connectors – Fiber
 - 1. LC
- J. Patch Cords – Fiber
 - 1. Multimode
 - 2. LC-LC
 - 3. Duplex
 - 4. Factory terminated
 - 5. Refer to PART 3 – EXECUTION for lengths
- K. Bonding and Grounding
 - 1. Primary bonding bus bar
 - 2. Secondary bonding bus bar
 - 3. Telecommunications bonding conductor
 - 4. Equipment bonding conductor
 - 5. 2-hole compression lug
 - 6. Grounding jumper
- L. Data Racks
 - 1. Floor mounted
 - a. 2-post
 - b. 84” tall

- c. Floor Mounted
 - d. Black
 - e. Chatsworth
 - 2. Vertical Wire Management
 - a. Chatsworth 35522-703
 - 3. Ladder Rack
 - a. Chatsworth 10250-712
- M. Power Strips
 - 1. Input Plug 5-20P
 - 2. 20A breaker
 - 3. 6' cord
 - 4. (24) receptacles, 5-20R
 - 5. Orientation – vertical
 - 6. Height – 60"
- N. Rack Ground Bark Kit
 - 1. Chatsworth 40172-001
- O. PoE Surge Protection
 - 1. Rack Mount
 - a. 24-Channel
 - b. STP Category 6
 - c. 10-GbE
 - d. Ditek DTK-RM24NETS
 - 2. In-line Surge Protection
 - a. Ditek DTK-MRJPOES

2.4 CABLE ROUTING/PATHWAY

- A. Cable Support System:
 - 1. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
 - 2. Cable supports shall not exceed a serviceable height of more than 5', but no closer than 2', above the finished ceiling.
 - 3. Cable supports can be attached to vertical walls or the building's structure.
 - 4. If attached to the building's structure, 3/8" threaded rod shall be utilized to extend down within the serviceable heights mentioned above. Grid wire hangers will not be accepted.
- B. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.
- C. Conduit Bushings shall be installed prior to the installation of any cable. No cut bushings will be accepted.
- D. Installer shall coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. Conduit fill shall not exceed 40% fill ratio.

PART 3 – EXECUTION

3.1 GENERAL

- A. Fire Wall Penetrations: The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- B. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.
- C. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.
- D. Pull Strings: Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.
- E. Conduit Fill shall not exceed 40%.
- F. Damage:
 - 1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
 - 2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.
- G. Clean up: All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.
- H. Conduit and Back Boxes
 - 1. The Contractor shall ensure that the projects electrical Contractor provides the appropriate back box and conduit for the project.
 - 2. One (1) 1" conduit will be required each outlet that serves (6) cables or less. Provide addition conduit for cable counts that exceed this number.
 - 3. One (1) double gang deep box will be required for each technology outlet. All boxes except Presentation outlets will be required to have a single gang reducer ring.

3.2 EQUIPMENT CABINET CONFIGURATION

- A. Equipment Cabinets: Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed.
- B. Wire Management Components: Horizontal cable management panels shall be installed directly above and below each patch panel. Vertical cable management panels shall be installed on each side of the cabinet.
- C. Cable Placement: Cable installation in the Wiring Closet must conform to the Project

Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

- D. Cable Routing: Cable shall be routed as close as possible to the ceiling, floor, or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.
- E. Installation: All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels. Cable bundles shall not exceed more than 48 cables to patch panel.
- F. Hardware: Provide cabinet and jack panel hardware as required for all data station wiring
- G. Distribution Cabinet/Cabinet Grounding
 - 1. All Cabinets and/or Cabinets shall be grounded using minimum stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance.
- H. Fiber Optic Patch Panels:
 - 1. ALL fiber strands must be terminated in fiber housing.
- I. Rack Electrical:
 - 1. A power strip shall be installed vertically at the back of each data relay rack.
 - 2. Plug power strip into owner provided UPS
- J. Cable Management Panels:
 - 1. Provide Velcro straps for cable dressing in MDF/IDF rooms
- K. MDF/IDF Patch Cables:
 - 1. Cabling Contractor shall provide owner with patch cable for each data drop on entire project.

3.3 STATION WIRING INSTALLATION

- A. General:
 - 1. Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
 - 3. All cable shall be routed to the center of the room in which it serves before routing to the outlet location and a 5' service loop shall be provide. An addition 5' service loop shall be provided above ceiling at the outlet location. All service loops shall be figure 8 loops.

4. Outlet Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project.
- B. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
 2. Additional exposed cable runs will require Owner approval and will only be allowed when no other options exist.
 3. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.
- C. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.
- D. Cable Routing:
1. All low voltage cabling shall be installed and supported using a J-hook style modular cable support system at maximum 60" intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.
 2. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
 3. Cable supports shall not connect to any ceiling grid wire or on any support attached to the ceiling grid.
 4. Cable supports shall not exceed a serviceable height of more than 5', but no closer than 2', above the finished ceiling.
 5. Cable supports can be attached to vertical walls or the building's structure.
 6. If attached to the building's structure, 3/8" threaded rod shall be utilized to extend down within the serviceable heights mentioned above. Grid wire hangers will not be accepted.
 7. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.
 8. Conduit Bushings shall be installed prior to the installation of any cable. No cut bushings will be accepted.
 9. Installer shall coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. Conduit fill shall not exceed 40% fill ratio.
 10. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
 11. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS.
 12. All (48) cable bundles shall be routed directly to the MDF or IDF that serves the area. All bundles shall remain separated for the length of the cable run.
 - a. Provide data outlet for irrigation controllers. Coordinate location with

- landscape consultant.
 - b. Provide data outlet for time clock appliance in main custodian office.
 - c. Provide OSP or flooded/gel filled cat6 cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.
- 13. Provide a 5' service loop at each workstation outlet properly supported above ceiling
 - 14. Provide minimum of 10' service loop at all headend locations properly supported above ceiling
 - 15. Provide indoor/outdoor, plenum rated category cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs.
- E. Rating: Cable shall be plenum rated if installed in plenum space

3.4 STATION HARDWARE

- A. Flush mount jacks shall be mounted in a faceplate with back box.
 - 1. Placement:
 - a. Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.
 - 2. Outlets shall be installed within 3'-0" of power outlets.
- B. RJ-45 Jack Pin Assignments:
 - 1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
 - 2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring).
- C. Information Outlet / Jack Modules:
 - 1. Provide additional qty. 25 of each Jack Module for owner's future use.
- D. Faceplates:
 - 1. Provide qty. 10 of each faceplate for owner's future use.

3.5 STRUCTURED CABLING SYSTEM

- A. Each connectivity solution shall be a complete Channel Solution, consisting of jacks, patch panels, and patch cables.
- B. Each channel solution shall be color coded to the system in which it serves.

3.6 SYSTEM SPECIFIC COLOR REQUIREMENTS

- A. The following information shall apply to the complete SCS Channel. All cable, patch cables, outlet terminations, and closet terminations shall be provided in the colors designated below. Coordinate exact colors with owner prior to purchasing.

Item	Description	Horizontal Cable	Insert	Patch Cables
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1	Data	Green	Green	Green
2	VoIP Telephone	Green	Green	Green
3	Wireless	Yellow	Yellow	Yellow
4	Camera	Purple	Purple	Purple
5	Access Control	Gray	Gray	Gray
6	Projector / TV	Blue	Blue	Blue
7	IP Speaker	White	White	White

3.7 COPPER PATCH PANELS

- A. Provide and install patch panels as per the instructions below:
1. 24-port patch panels shall only be used for copper tie cables and demarcation extensions.
 2. Provide dedicated, 48-port patch panels for each of the following system (reference color code chart for designated insert and patch panel color coding per system):
 - a. Wireless Access Points, LAN, IP Telephones, and Video Surveillance Cameras

3.8 COPPER AND FIBER OPTIC PATCH CABLE LENGTHS

- A. Provide copper and fiber optic patch cables as per the instructions below. All patch cables shall be factory terminated and warranted for the copper and fiber solutions specified. Patch cable color shall match termination jack. Provide one patch cable and station cable for each port on the entire project.
1. For each termination in the MDF:
 - a. Patch cable lengths
 - (1) 90% shall be 7'
 - (2) 10% shall be 10'
 2. For each termination in a wall jack:
 - a. Patch cable lengths
 - (2) 100% shall be 10'
 3. For each termination for video surveillance cameras:
 - a. Patch cable lengths
 - (1) Interior Cameras: 100% shall be 10'
 - (2) Exterior Cameras: 100% shall be 15'
 4. For each termination in a 6-port surface mount box:
 - a. (1) 3' patch cord shall be green (AV)
 - b. (2) 15' patch cord shall be yellow (WAP)
 - c. (1) 15' patch cord shall be white (IP Speaker)
 - d. (1) 21' patch cord shall be blue (Display/Projector)
 4. Fiber Optic Patch Cables:
 - a. Provide quantity sufficient for connecting all network equipment plus 20% for growth.
 - b. Patch cable lengths:
 - (1) 100% shall be 3 meters.

3.9 DOCUMENTATION

- A. Labels: The Contractor will label all outlets using permanent/legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font

shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

1. The following nomenclature should be used when labeling data/voice jacks:
 - a. All cables being served by MDF closet shall begin with '1' all IDF served cables shall begin with a numerical digit (2 thru 25) designating the specific ADF's identification.
 - b. Next identification letter shall refer to patch panel that is serving outlet (A, B, C).
 - c. Next identification shall note what # data port on patch panel (01 thru 48).

Example:

Label of an outlet from 23rd port of the third patch panel from top of rack located at IDF-2 shall read: 2-C-23.

Label of an outlet from the 5th port of the second patch panel from the top of rack located in the MDF shall read: 1-B-05.

- B. Floor Plan: A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.
- C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.
- D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.
- E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.
- F. Access Points: Label ceiling grid with digital label according to location installed and a bright orange 3/4" round dot sticker.

3.10 CABLE TESTING REQUIREMENTS

- A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures:
 1. Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
 2. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "*" PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".
- D. Errors:

1. When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.
- E. Twisted Pair Cable Testing:
 1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Products shall be tested for compliance with ANSI/TIA/EIA 568A and ISO/IES 11801. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the Contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
 2. Each wire/pair shall be tested at both ends for the following:
 - a. Wire map (pin to pin connectivity)
 - b. Length (in feet)
 - c. Attenuation
 - d. Near end cross talk (NEXT)
 - e. Power Sum
 3. Test equipment shall provide an electronic and printed record of these tests.
 4. Test results for each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.
- F. Fiber Optic Cable Testing
 1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test t0.and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
 2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
 3. After installation the Contractor shall test each fiber strand in accordance the EIA 455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for single mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
 4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
 5. Singlemode: Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.
 6. Multimode: 50/125um micron multimode fibers shall have a maximum attenuation of 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm. Minimum bandwidth shall be 2000 MHz/km at 850 nm and 500 MHz/km at 1300 nm.

3.11 INSPECTION

- A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.
 1. Written Test Report:
 - a. Complete test results, including actual values associated with tests.

- b. Show all certifications for telecommunications wiring systems.
 - c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCAD format. Provide electronic copy of drawings to owner in AutoCAD version 2012 or greater.
 - d. Documentation of outlet, cable, and cabinet labeling system.
- B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed, and test results certify system to all specified standards.

END OF SECTION

Bradley Kalmans



10/23/2024

SECTION 281000 - ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
 - 1. Conditions of the Contract
 - 2. Division 1
 - 3. Division 26
 - 4. Division 27
 - 5. Division 28

1.2 WORK INCLUDED

- A. The Contractor shall furnish and install a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.
- B. Security system devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system, meeting the requirement of specification. The Contractor shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.
- C. The system shall include security for all access into building, including but not limited to the following:
 - 1. Control Panels
 - 2. Power Supplies.
 - 3. Interconnection of panels.
 - 4. Installation of new devices.
 - 5. Card reader.
 - 6. Magnetic locking hardware
 - 7. Request to exit devices
 - 8. Door position sensors
 - 9. Door Hardware (as specified herein and/or in Division 08, door hardware)
 - 10. Servers
 - 11. Clients
 - 12. Mobile application
 - 13. Badging Station; including Enrollment Readers, Cameras, Software, and Printers
 - 14. Lockdown and Lockout Buttons
 - 15. Audio Intercom Systems
 - 16. Licensing
 - 17. Integration
 - 18. All additional material, hardware, and labor required for a fully functional, turnkey system
- D. The contractor shall connect each controller to the ACS Management System.

- E. All system programming will be performed by the system installer. The system installer will be required to meet with the Owner, engineer, and system manager to discuss wiring and termination of the system control panels and field devices prior to installation.
- F. Licensing: The contractor shall NOT utilize any of the owner's existing licensing for this scope of work. All licensing shall be provided by the contractor, no exceptions. Including, but not limited to the following:
 - 1. Portal Licensing
 - 2. Controller Licensing
 - 3. Wireless Licensing
 - 4. Video Management Software Integration Licensing
- G. Contractor to refer to specification 08 71 00 Door Hardware. Provide and install all hardware specified to be provided by the "Access Control Contractor", "Security Installer", "Division 28", or any variation thereof.
- H. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 REFERENCES

- A. Code of Federal Regulations (CFR).
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 802.3 Ethernet Standards.
 - 2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.
- C. International Electrotechnical Commission (IEC).
- D. International Organization for Standardization (ISO):
 - 1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
 - 2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
 - 3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).
- E. Federal Communications Commission (FCC):
 - 1. FCC Part 15 – Radio Frequency Device
- F. Underwriters Laboratories (UL):
 - 1. UL294 – Access Control Systems Units

- G. Electronic Industries Alliance (EIA)
 - 1. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems
- H. Federal Information Processing Standards (FIPS)
 - 1. Advanced Encryption Standard (AES) (FIPS197)
 - 2. FIPS201-2: Open Options DNA Fusion FIPS in conjunction with an E2-SSP-D2-FIPS, NSC-100-FIPS, RSC-2-FIPS and other listed components will provide an access control solution that is fully FIPS 201-2 compliant.
 - 3. Personal Identity Verification (PIV) of Federal Employees and Contractors
- I. Homeland Security Presidential Directive 12 (HSPD12)
- J. National Fire Protection Association Standards:
 - 1. NFPA 70 - National Electrical Code
 - 2. NFPA 72 - National Fire Alarm Code
 - 3. NFPA 101 - Life Safety Code
- K. RoHS compliant
- L. SIA AC-01-1996.10 - Access Control - Wiegand
- M. Local & State Building Codes
- N. Requirements of Local Authorities having Jurisdiction
- O. Requirements of American Disabilities Act (Public law 101-336).
- P. Texas Accessibility Standards (T.A.S.)
- Q. Texas Insurance Code.

1.4 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. The installing contractor shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years.
 - 2. The installing contractor shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
 - 3. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
 - 4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
 - 5. All Contractors must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper

- manufacturer's certification.
6. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
 7. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
 8. For proper, smooth, and complete integration of the IP security camera, access control, and intrusion detection systems; the proposing/installing contractor of the video surveillance and intrusion detection systems must be the same contractors.
 9. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.

1.5 SUBMITTALS AND CLOSE-OUT

- A. Product Data: Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
 1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 2. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
 3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
 4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
 5. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
 - a. Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
 - b. Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the

- owner, architect, and/or project's technology consultant.
 - c. Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system
- B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - 1. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
 - 2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - a. Location of all control equipment and remote power sources
 - b. Locations of all field devices and outlets
 - c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
 - e. Location of sleeved wall and/or floor pass-thru
 - f. Size of sleeve at each location installed
 - g. Quantity of cable passing through each sleeve
 - h. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.
 - 3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.
- C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:
 - 1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 - 2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
 - 3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - 4. The manual shall also include Manufacturer's data sheets and installation

- manuals/instructions for all equipment installed and a list of recommended spare parts.
5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
 7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
 8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
 9. A copy of the manufacturer's warranty on the installed system.
 10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
 11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
 12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
 13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. Contractor shall provide one complete floor plan sheet at each panel location.

1.6 DEFINITIONS

A. Abbreviations:

1. ACS Access Control System
2. VMS Video Management System
3. NVR Network Video Recorder
4. IDS Intrusion Detection System
5. GUI Graphical User Interface
6. IP Internet Protocol
7. CR Card Reader
8. DS Door Station
9. MS Master Station
10. PIR Passive Infrared Sensor
11. LD Lockdown
13. LO Lockout
14. MDF Main Distribution Frame
15. IDF Intermediate Distribution Frame

B. Definitions:

1. Access Card: A coded employee card, usually the size of a credit card,

- recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, wiegand-effect, proximity (active/passive), barium ferrite, smart/intelligent cards, and NFC enabled applications on mobile devices.
2. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secured areas.
 3. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through and the times they are permitted.
 4. Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.
 6. Alarm: A signal that indicates a problem.
 7. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
 8. Badge: Badge is a template or a design for creating a card. DNA Fusion includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
 9. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
 10. Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).
 11. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
 12. Controller: A microprocessor-based circuit board that manages access to a secured area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
 13. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
 14. Digital Video Recorder: A security system device that records the video from the surveillance cameras (IP and Analog) on a hard disk.
 15. Door: A generic term for a securable entry way. In many access control applications, a "door" may be a gate, turnstile, elevator door, or similar device.
 17. Duress: Forcing a person to provide access to a secure area against that person's wishes.
 18. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller.
 19. Integrated lockset: An integrated, intelligent locking solution that typically runs on batteries, but can be externally powered, that contains most of the door components, i.e. reader, door contact, and request to exit in a single, mountable unit.
 20. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer keyboard.

21. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically, the state change prompts an action outside of the controller such as activating or deactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
22. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
23. Time Schedules: Schedules that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
24. Video Management System: An enterprise-class video management and storage solution

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

- A. The ACS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Approved Manufacturers:
 1. Verkada

2.2 SERVERS AND USER INTERFACE

- A. Provide licenses and subscriptions for minimum 1-year for cloud-based software
- B. Provide programming and user interface customization to owner's requirements.

2.3 ACCESS CONTROL SYSTEM (ACS)

- A. General: The ACS is a modular and networked based system providing physical access control security to a Wide Area campus enterprise. The system shall be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACS shall include, but is not be limited to, the following:
 - 1. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.
 - a. The ACS to permit multiple instances of client software applications to run simultaneously on the network. The base system shall include one (1) software application licenses per site with an unlimited number of licenses available subject to connection fees.
 - 2. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
 - a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
 - 3. Encryption: The system to support encrypted communication between the central server software and client software applications (server-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
 - a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
 - b. The ACS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
 - 4. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
 - a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points

- at perimeter points system wide.
5. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
 6. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
 7. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database, and import / export of employee data.
 8. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
 9. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
 10. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
 11. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
 12. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
 13. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
 14. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
 15. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
 16. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.
 17. Systems Integration: The system to have the ability to be fully and seamlessly integrated with existing or specified IDS and VMS.
- B. Open Architecture: The access control system infrastructure will be based on an open architecture design capable of supporting multiple access control hardware manufacturers and integrate with multiple non-proprietary network processors, controllers, interface

modules, integrated locking hardware, remote card readers, keypads and display terminals, and other third party applications.

- C. Open Protocol: The ACS manufacturer to provide non-proprietary, open protocol hardware for the system control processors and associated device sub-controllers. Systems utilizing a single manufacturer solution that encompasses combined proprietary software and integrated electronic hardware combinations are not acceptable. In addition, integrated electronic locking hardware requiring a processor or sub-controller module upgrade, or extensive access control firmware upgrades to accommodate integrating with an alternate software package, will not be considered.
- D. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be designed to support all of the following:
 - 1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
 - 2. Direct-connected RS-232 and RS-485 communication cabling.
 - 3. Dial-up modem connection using a standard dial-up telephone line.
- E. Provide local communication port at each panel for local configuration of system with laptop.
- F. Locate all main control panels in MDF and IDF rooms of each building.
- G. Provide 120v at all controller and power supply locations.
- H. Provide and transfer all required licensing to the owner.
- I. Provide local communication port at each panel for local configuration of system with laptop.
- J. Provide and install all software and/or hardwire connections required to connect the system to IDS and VMS.
- K. Integrated Biometrics: The ACS shall support integration with the following biometric solutions:
- M. Integrated Video Management Systems: The ACS shall support integration of DVR and/or NVRs from the following manufacturer. Integration to be completed by the system installer:
 - 1. Verkada Cloud-Based software

2.4 ACCESS CONTROL PANEL HARDWARE

- A. Access Controllers:
 - 1. AC12 – 1 door, 2 readers, 2 aux
 - 2. AC41 – 4 doors, 2 aux
 - 3. AC42 – 4 doors, 2 aux, 1 FAI
 - 4. AC62 – 16 doors, 2 aux, 1 FAI
 - 5. AX11 – 16 dry inputs, 16 relay outputs, 1A/24VDC contacts

2.5 FIELD DEVICES

- A. General: Coordinate with door hardware and access control schedule as to whether each access control portal is wireless or directly connected to a control panel. Provide all Controllers, Sub-Controllers, and licensing as required to connect all card reader locations shown on plan.
- B. Card Readers:
 - 1. Provide card readers as shown on the floor plans, and access control details
 - 2. Card readers shall be:
 - a. AD34
 - b. AD64
- C. Credentials: Coordinate Facility Code, External Start Number, and Internal Start number with the Owner prior to procuring credentials.
 - 1. DESFire EV3 Credentials
 - 2. Provide 300 credentials
- D. Miscellaneous Devices: Provide the following devices as designated per the project floor plans, access control schedules, and access control details:
 - 1. DP/DT Door Position Sensors (Door Contacts)
 - 2. PIR Motion Request to Exit Sensor
 - 4. Door Release Buttons

2.6 WIRING

- A. Ethernet cabling shall be provided by the Structured Cabling System Installer. In the event that there is not ACS installer on the project, cabling shall be provided and installed by the Access Control System Integrator and shall comply with the Division 27 Structured Cabling specification.
- B. Conventional access control cable shall be a jacketed composite cable or data cabling for IP based devices
- C. Wire scheme and conductor quantity shall be as required by the manufacture's specifications. Contractor to provide and install shielded cable as required.
- D. All 120v Power shall be furnished by the Division 26 contractor. In the event that a division 26 contractor is not contracted for the project, the system installing contractor shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.
- E. All Security Conduit as required for a complete installation of this system shall be furnished by the division 26 contractor as part of their scope of work. In the event that a division 26 contractor is not contracted for the project, the system installing contractor shall provide and install all conduit required.
- F. Coordination with the Division 26 contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.
- G. All systems shall be connected to a dedicated circuit and on an emergency power source

if available.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so, approved by the local authority having jurisdiction.
- C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.
- D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
- E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
- F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
- G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- H. Network Connection Cable: Provide a 4 pair Category 6 data cable from the Master Control Panel to the MDF network rack. Category 6 cable shall be purple in color.
- I. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
- J. Contractor is required to provide all mapping and software configuration required to operate system as per manufacturer's recommendations.

3.2 CABLE PATHWAYS

- A. Cable Support:
 - 1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.

- a. Approved Cable Support Product:
 - 1) Panduit
 - 2) Arlington
 - 3) Caddy
 - 4) Support system shall be sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.
 2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
 3. J-MOD™ cable support shall be installed at a maximum of 5' on center.
 4. All cable installed shall be attached to the J-MOD™ support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD™ cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
 5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
 6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
- B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
 2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
 3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
 4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
 5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

3.3 SYSTEM ZONING AND PARTITIONING

- A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.

3.4 TESTING

- A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner and the project's Technology Consultant and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.
- B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.5 WARRANTY

- A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

3.6 SOFTWARE

- A. Provide two electronic copies of the final programming and program software to the Owner's Security Supervisor after final approval.

Bradley Kalmans

END OF SECTION



10/23/2024

SECTION 282000 - VIDEO SURVEILLANCE SYSTEM (VSS)

PART 1 – GENERAL

1.1 RELATED WORK

- A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
 - 1. Conditions of the Contract
 - 2. Division 1
 - 3. Division 26
 - 4. Division 27
 - 5. Division 28

1.2 GENERAL PRODUCT REQUIREMENTS

- A. The software used shall be designed for enterprise level use, with an expected use period of 24/7. It shall be the Manufacturer's official software.
- B. The software shall incorporate open standards and published protocols and use standardized components.
- C. The Video Management System provider shall be defined as the provider of the video management software, and the party responsible for rigorous self-testing of the video management software prior to the release of the software.

1.3 GENERAL SYSTEM DESCRIPTION

- A. The Video Management System shall support both centralized and decentralized configurations as well as hybrid options for architecture. Centralized management shall be available no matter the surveillance architecture. The system shall allow for integration with other security devices and products and be designed to allow for leveraging of those products to improve the user experience of the VMS.
- B. The VMS shall not require a central management server.
- C. The VMS shall make the user experience seamless to the end user irrespective of the system architecture.
- D. The VMS must be capable of each server being able to handle an unlimited number of cameras for recording.
- E. The VMS must support Windows Server 2008, 2012, and Windows Server 2016 for the server side. Client- side software must be available for Windows 7, 8 and 10, Mac OSX, iOS 6 and above, and Android. The operating system shall have all current and available patches.
- F. The VMS shall include the following without additional license fees:
 - 1. Client software for Windows.
 - 2. Client software for Mac OSX.

3. Client software for iOS 6 and above.
 4. Client software for Android-based platforms.
 5. Client software using a web-based interface.
 6. Standalone clients designed to provide fixed displays.
 7. Video Wall functionality.
 8. SmartSearch.
 9. Access Control Integration.
 10. Full Access Control software platform.
 11. Failover server functionality.
 12. A separate health monitor application.
- G. The VMS shall not require a separate application for administration and user-based roles. Limitations for non-administrative users shall be handled via permissions.
- H. The system shall support running in Virtual Servers for both the server application and client applications

1.4 SECTION INCLUDES

- A. Video Management Systems:
1. Server application.
 2. Desktop application.
 3. Mobile application.
- B. Servers:
1. Rackmount.
 - a. Servers will be provided, installed, and programmed by the system installer.
 - b. Server sizes and quantities shall be based on the needs to meet the requirements established by, but not limited to the following:
 - 1) Bandwidth
 - 2) Camera resolution
 - 3) Client workstation access
 - 4) Frame rates
 - 5) Video Compression
 - 6) Motion based recording
 - 7) Maximum of sixty-four (64) views per server
 - 8) Days of Retention
 - c. Provide a minimum of one server per site
- C. IP security cameras.
- D. VMS software licenses.
- E. Encoders and decoders.
- F. Controller systems.
- G. Accessory products.

1.5 REFERENCES

- A. Code of Federal Regulations (CFR).
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 802.3 Ethernet Standards.
- C. International Electrotechnical Commission (IEC).
- D. International Organization for Standardization (ISO):
 - 1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
 - 2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
 - 3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).
- E. Federal Communications Commission (FCC):
 - 1. FCC Rules and Regulation of Title 47 of CFR Part 15 Subpart B Class A.
- F. Open Network Video Interface Forum (ONVIF):
 - 1. ONVIF - Profiles S Specification.
- G. Underwriters Laboratories (UL):
 - 1. UL listed.

1.6 DEFINITIONS

- A. Abbreviations:
 - 1. ARP - Address Resolution Protocol.
 - 2. DHCP - Dynamic Host Configuration Protocol.
 - 3. DNR - Digital Noise Reduction.
 - 4. DDNS - Dynamic Domain Name Server.
 - 5. FPS - Frames Per Second.
 - 6. GUI - Graphical User Interface.
 - 7. HDD - Hard Disk Drive.
 - 8. HTTP - Hypertext Transfer Protocol.
 - 9. ICMP - Internet Control Message Protocol.
 - 10. IGMP - Internet Group Management Protocol
 - 11. IP - Internet Protocol.
 - 12. iSCSI - Internet Small Computer System Interface.
 - 13. JBOD - Just a Bunch of Disks.
 - 14. JPEG - Joint Photographic Experts Group.
 - 15. MJPEG - Motion JPEG.
 - 16. MP - Megapixel.
 - 17. MPEG - Moving Pictures Experts Group.
 - 18. NAS - Network Attached Storage.
 - 19. NTP - Network Time Protocol.
 - 20. POS - Point of Sale.

21. PPPoE - Pont to Point Protocol over Ethernet.
22. RAID - Redundant Array of Independent Disks (Drives).
23. RTP - Real-Time Transport Protocol.
24. RTCP - Real-Time Control Protocol.
25. RTSP - Real-Time Streaming Protocol.
26. SMTP - Simple Mail Transfer Protocol.
27. SNMP - Simple Network Management Protocol.
28. SSL - Secure Sockets Layer.
29. TCP - Transmission Control Protocol.
30. UDP - User Datagram Protocol.
31. UPnP - Universal Plug and Play.
32. VMS - Video Management System.
33. PoS - Point of Sales.
34. VA - Video Analytics.
35. PnP - Plug and Play.
36. ARB - Auto Recovery Backup.
37. NVR - Network Video Recorder.
38. RAID - Redundant Array of Independent Disks.

B. Definitions:

1. JBOD: A collection of hard disks that have not been configured to act as a redundant array of independent disks (RAID) array.
2. GOV (Group of Video object planes): A set of video frames for H.264 and H.265 compression, indicating a collection of frames from the initial I-Frame (key frame) to the next I-Frame. GOV consists of 2 kinds of frames: I-Frame and P-Frame.
3. Dynamic GOV: Dynamic assignment of GOV length based on the complexity of the scene to efficiently manage bitrate of the video stream and reduce the storage required.
4. Dynamic fps: Dynamic assignment of frames per second based on the complexity of the scene to efficiently manage bitrate of the video stream and reduce the storage required.
5. ARB (Auto Recovery Backup): Automatic backup mechanism that enables cameras to store videos on to SD card during failures and stream it to the storage device after recovery.
6. Failover: A feature that automatically switches to a redundant or standby device upon failure or unexpected shutdown of an active device.

1.7 SUBMITTALS

A. Project Initiation:

1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
 - a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
 - b. Product Literature: Complete manufacturer's product literature for all material, hardware, and equipment to be used in the installation of the specified system. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating

compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicate what specific product is to be provided

- c. Construction Schedule: A time-scaled Construction Schedule, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
- d. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
- e. Each Submittal must have a detailed parts list. Quantities will not be required as the quantity of any portion of this system shall be as required for a complete and functional system and in conjunction with the contract documents.
- f. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expire any sooner than 12 months after substantial completion of the project.
 - 1) Physical Security Professional (PSP) Certification: This certification must be held by an on-staff, full-time employee of the system installer. The holder must be staffed out of the office that is located within 75 miles of the projected.
 - 2) Manufacturer Authorized Dealer Certification must be held by the system installer's office that is located within 75 miles of the project and shall be a company certification, not an individual certification.
 - 3) Installer Certifications: Certification indicating that an individual has successfully completed installer training, issued by the VMS and Cameras Manufacturers specified herein, must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

B. Shop Drawings:

- 1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
 - a. Proposed cable routing and grouping plan.
 - b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
 - 1) Location of sleeved wall and floor pass-thru
 - 2) Size of sleeve at each location installed
 - 3) Quantity of cable passing through each sleeve
 - 4) Location of devices and head end equipment.
 - 6) Conduit routing, size, and quantity
 - c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general,

- keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.
- d. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.
- C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.
- D. Close-out Procedures:
- 1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:
 - a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
 - b. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
 - c. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.
 - d. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
 - e. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
 - f. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.
 - g. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

- h. A copy of the manufacturer's warranty on the installed system.
- i. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
- j. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
- k. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5-year experience manufacturing similar products.
- B. System Integrator shall provide the following as part of the System Solution:
 - 1. Complete product and technical data specification sheets that include all material and equipment and shall be available freely online.
 - 2. List of all equipment with part numbers, manufacturer, firmware, and assigned IP addresses.
 - 3. Locations and details for all components to be installed under this scope of work.
 - 4. Placement Diagram showing the proposed location of all system hardware devices.
 - 5. System Calculation of all network bandwidth and storage requirements for System Servers to ensure proper planning of computing and networking infrastructure.
- C. Installer Qualifications: Minimum 10-year experience installing similar products. Installers shall be trained and authorized by the Manufacturer to install, integrate, test, and commission the system.

1.9 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Handling: Handle materials to avoid damage.

1.11 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under

environmental conditions outside manufacturer's recommended limits.

1.12 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.13 WARRANTY

- A. The security system VMS software and labor furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance of the Video Surveillance System.
- B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.
- C. Software Licensing and Warranty:
 - 1. Software licensing should be on a per device basis (e.g. 1 x license for 1 IP Camera or I/O device) with no base license for additional features or capabilities.
 - 2. The VMS Software should be completely free for live streaming or playback of offline media files (images, videos).
 - 3. Lifetime software upgrades shall be provided by the Manufacturer without cost and without the need for an annual maintenance agreement.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
 - 1. Verkada

2.2 IP SERVER

- A. Verkada Cloud-Based software
- B. Live view will allow views of 1, 2, 4, 8, 9, 10, 13, 16, 25 and 36 cameras. A widescreen option for 18 and 24 cameras will also be available.
 - 1. Layouts will be selectable via icon.
 - 2. Layouts will not be limited to cameras from a single server.
 - 3. Users will be able to get layouts to cycle in the client's workspaces.
 - 4. Layouts shall be able to be put into groups.
- C. If motion is detected on a camera, the software shall have the option to indicate it by highlighting the edge of the live window.
- D. Live view will allow cameras to be dragged and dropped onto the live view from the left-hand tree. Cameras can be duplicated in a view.
- E. Users will be able to invoke a digital zoom by drawing a box.

- F. Digitally zoomed areas will be treated as a digital PTZ.
- G. PTZ Presets shall be listed in a drop-down menu in the Dynamic Tab.
- H. Users shall be able to move the PTZ movements simply by clicking on the image, through onscreen PTZ controls. Zoom functionality can also be controlled via the scroll wheel of the mouse.
- I. Live view will support a full screen mode that hides the UI. User shall be able to start VI MonitorPlus in this full screen mode with a setting.
- J. Live view shall allow the user to de-warp the video from panoramic lenses and cameras.
- K. Right clicking on a camera in live view will have the following behaviors:
 - 1. Right clicking on a camera within live view will allow the user to be able to review the recently recorded video for that camera.
 - 2. Right clicking on a camera within live view will also allow access to the properties dialog box for that camera.
 - 3. Right clicking on a camera will bring up the option to save a still image of the live view.
 - 4. Live audio will be able to be accessed by right clicking on a camera in the live view.
 - 5. Allowing access to recorded video.
 - 6. Right-clicking on the Camera tile will allow the users to send video or messages to other users in the form of a popup window.
- L. The system will support an Alarm Log to make it easier to find DIO based events.
- M. Facility maps will be available in the software for viewing.
 - 1. When the user hovers over a camera in the facility map it will display the camera in a window off the side of the map.
 - 2. While a camera is displayed it will allow access to recorded video from that camera as well as the live stream.
 - 3. Cameras will display where they are pointed.
 - 4. Embedded layouts will change the layout of VI MonitorPlus if they are clicked on.
 - 5. Embedded Facility maps will cause the current map to change to the embedded map if clicked on.
 - 6. The user will have the option of importing and placing doors from supported access control partners on the map. This shall allow them to see badge events as well as alarm events. It shall also support the ability to lock and unlock doors from the map.
 - 7. Integrated Panic button events will be visible on the facility map.
- N. The software shall support the ability to open a live window that can be moved around. This window will be able to access the view of any camera or layout the user has access to.

- O. The user will be able to enable or disable the following settings:
 - 1. Server name in the live view.
 - 2. Camera Name in the live view.
 - 3. Audio notification on motion.
 - 4. Forcing aspect ratio.
 - 5. Use Direct Show for display.
 - 6. Double clicking to change the server layout.
 - 7. Double clicking expands the camera.
 - 8. Allowing multiple live windows.
 - 9. Block live windows from popping up.
 - 10. Live window always on top.
 - 11. The speed in which layouts cycle.
 - 12. Hiding left tree on start up.
 - 13. Launching Facility maps on start up.
- P. Users with Administrator privileges will be able to configure the server and camera settings. Users will also be able to test SMTP settings and database settings.
 - 1. Users will be able to configure the framerate of the camera, including the option to have the server record continuously from 1 to 3 fps with the option to go to the cameras designated frame rate on motion detection.
 - 2. Users will be able to select various time-lapse options for the camera.
 - 3. Users will be able to select the camera stream type.
 - 4. Users will be able to select camera or server-side motion detection.

2.4 WEB CLIENT

- A. The Web Client shall be a truly thin client with no download required other than an internet web browser or standard web browser plugins.
- B. The Web Client shall be platform independent and run within Microsoft Edge, Internet Explorer, Firefox, Safari, and Google Chrome.
- C. Users will not be able to change any settings within IP Server via the thin client without Admin privileged.
- D. Users will be able to select layouts for live viewing, or individual cameras or groups of cameras.
- E. Users will be able to access recorded video.
- F. Users will be able to download recorded video from the system.
- G. Users will be able to use the motion log to find recorded video.
- H. The Web Client shall support the use of facility maps.
- I. The Web Client will support the use of custom layouts.
- J. The Web Client shall allow remote access for iPhone, Blackberry, Windows Mobile, and

Android mobile phones without the installation of an app.

2.5 HEALTH MONITOR

- A. Front end, or by sending out an e-mail to one or more users.

2.6 VIDEO WALL

- A. The VSS shall support video wall applications by connecting and controlling multiple workstations and monitors simultaneously.

2.7 VSS MOBILE APPLICATION

- A. The VSS shall support module applications that run on the following Operating Systems:
 - 1. Google Android.
 - 2. Android 4.0: Ice Cream Sandwich thru the most current version
 - 3. Apple iOS: 5 thru the most current version
- B. The App will have access to live cameras.
- C. PTZ functionality will be available in the App.
- D. The App will have access to recorded video.
- E. Snapshots will be able to be e-mailed from the App.

2.8 CLIENT WORKSTATIONS

- A. Contractor to provide one (1) client workstation with the installation location to be determined at the time of install. Additional workstation will be furnished by the Owner as required.
- B. Contractor shall include configuration of two (2) additional, owner furnished workstations.

2.10 CAMERAS

- A. Camera Types:
 - 1. Tamper resistant with all movable parts enclosed behind a protective cover.
 - 2. Integrated Dome In-Ceiling flush mount.
 - 3. Water resistant.
 - 4. 3-year warranty on all cameras.
- B. Color Cameras
 - 1. Acceptable Manufacturers: Verkada
 - a. Dome
 - b. Multi-Sensor
 - c. Fisheye
 - 2. Performance

- a. Dome – 5MP
 - b. Multi-Sensor – 20MP
 - c. Fisheye – 12MP
- C. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.

2.11 ADDITIONAL HARDWARE OR EQUIPMENT REQUIRED

- A. Licensing
 - 1. Provide the owner with all licenses as required for installation

PART 3 - EXECUTION

3.1 PREPARATION

- A. System Integrator: Confirm the solution proposal planning and design with the installing contractor.
- B. The network design and configuration to be verified for compatibility and performance with the input/output devices.
- C. Network Configuration: Tested and qualified by Contractor prior to remote device installation.
- D. Equipment to be tested and configured in accordance with instructions provided by the manufacturer prior to installation.
- E. All firmware found in products to be the latest and most up to date provided by the manufacturer, or of a version as specified by the provider of the Video Management Application (VMA).
- F. All equipment requiring users to log on using a password to be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.
- G. Confirm hardware will be stored in an environment where temperature and humidity are in the range specified by the Manufacturer.

3.2 INSTALLATION

- A. General
 - 1. Install products per manufacturer's recommendations and approved submittals.
 - a. Comply with documentation provided by the System Integrator to ensure all steps have been taken to provide a reliable, easy-to-operate system.
 - 2. Contractor personnel must comply with all applicable state and local licensing requirements.
 - 3. Before permanent installation of the system, the Contractor will test the system in conditions simulating the final installed environment witnessed by the System

Integrator. Adjust as required until proper operation is achieved.

B. Cable Support:

1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
3. Cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to insure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
7. Do not route cable through webbing of structural steel.

C. Conduit / Raceway:

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

- D. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.
- E. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.
- F. Provide three-sided pre-finished metal hood and seal to wall where conduit penetrates exterior wall.

- G. Install new roof mounted conduits on portable pipe supports – (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.
- H. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top and sides (not bottom)

3.3 EQUIPMENT RACK CONFIGURATION

- A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.
- B. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.
- C. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

3.4 WIRING INSTALLATION

- A. General:
 - 1. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
 - 2. All cable must be handled with care during installation so as not to change performance specifications.
- B. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

3.5 DOCUMENTATION

- A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.
- B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner's labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic

coated) on all cables and outlets.

- C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.
- D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.6 CABLE TESTING - BY MANUFACTURER'S REQUIREMENTS

- A. Notification: The Owner/Architect/Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
- B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.
- C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.
- D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

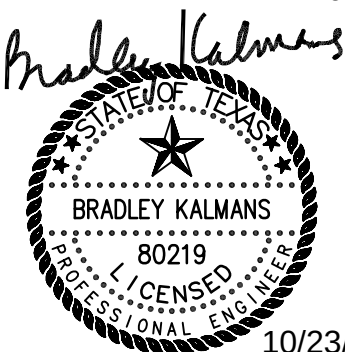
3.7 INSPECTION

- A. Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/Architect/Engineer may observe before acceptance.

3.8 WARRANTY

- A. Guarantee and warrant all equipment provided for a period of 3 years following date of substantial completion, or a period equal to the stated guaranty/warranty offered by the product manufacturer, whichever is the longest in duration.
- B. All such warranties shall include all parts (DVR's, and Power Supplies).
- C. Labor and all other costs as necessary to maintain the equipment in operating condition as intended by the product manufacturer after a period of 1 year shall be negotiated with the owner upon project completion

END OF SECTION



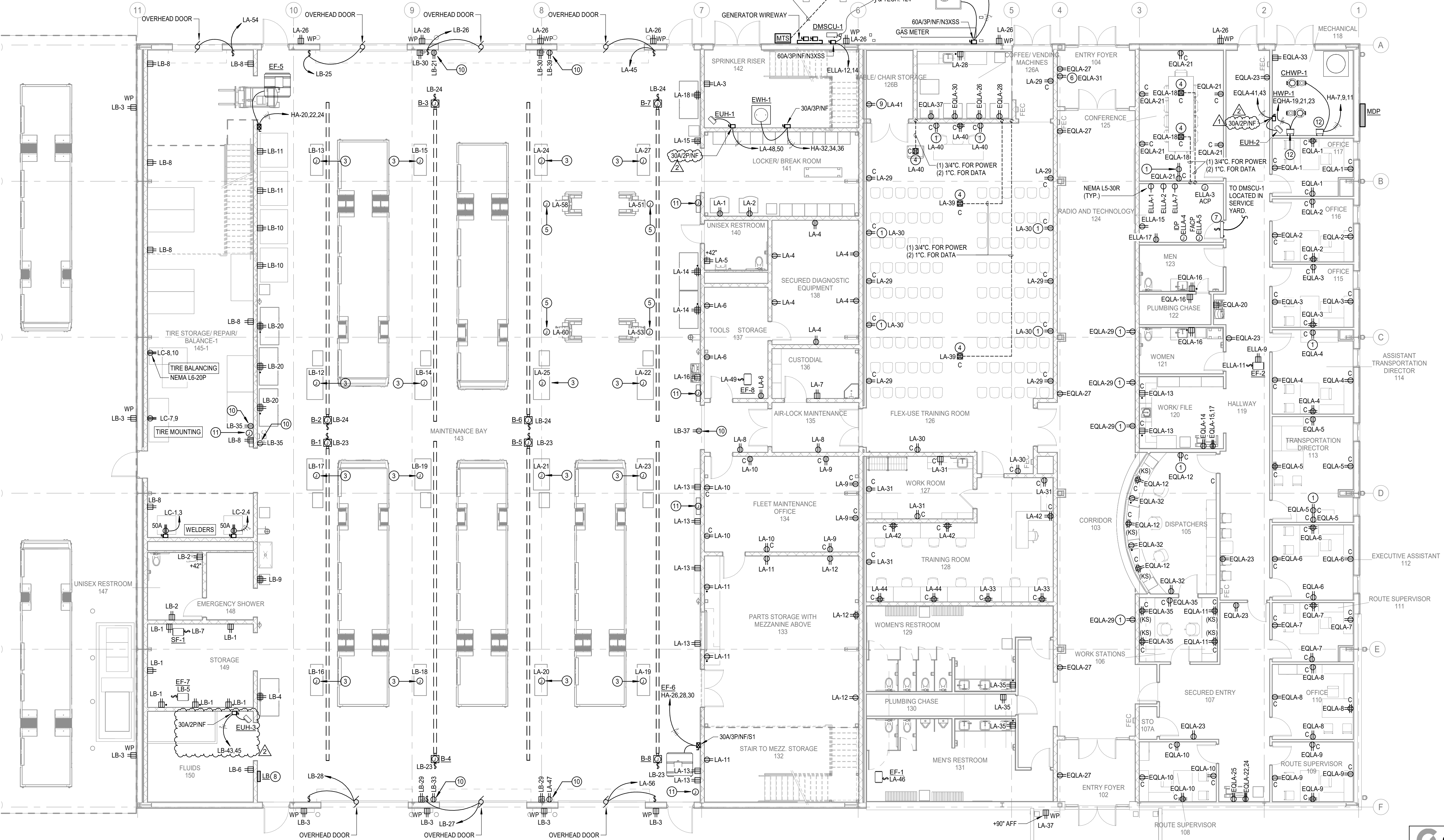
10/23/2024

ELECTRICAL KEYED NOTES	
#	Description
1	RECEPTACLE FOR WALL MOUNTED DISPLAY. CONTRACTOR TO COORDINATE FINAL LOCATION WITH ARCHITECT/OWNER PRIOR TO ROUGH-IN COMPLETION.
3	PROVIDE ELECTRIC CORD REEL WITH GFCI DOUBLE DUPLEX RECEPTACLE. MOUNT REEL TO BOTTOM OF STRUCTURE.
4	PROVIDE 6-GANG CONCEALED SERVICE MULTI-ACCESS FLOOR BOX WITH (1) DUPLEX RECEPTACLE, (1) "CONTROLLED" RECEPTACLE, AND DATA/AV DEVICES REQUIRED BY TECHNOLOGY. PROVIDE WIREMOLD #6RFB-A-SERIES OR APPROVED EQUAL.
5	PROVIDE ELECTRIC CORD REEL WITH GFCI DOUBLE DUPLEX RECEPTACLE FOR VEHICLE LIFT CHARGING. MOUNT REEL TO BOTTOM OF STRUCTURE.
6	CONTRACTOR TO COORDINATE EXACT LOCATION FOR TIME CLOCK RECEPTACLE WITH OWNER/ARCHITECT PRIOR TO ROUGH-IN. CONTRACTOR TO MAKE FINAL FINAL CONNECTION.
7	INDOOR MINI SPLIT POWERED FROM OUTSIDE CONDENSER ROUTE #12, #12S, 3/4". FROM OUTDOOR UNIT TO INDOOR UNIT. MAKE FINAL CONNECTIONS.
8	CONTRACTOR TO PAINT LINE ON FLOOR IN ACCORDANCE WITH CODE CLEARANCE.
9	CONTRACTOR TO COORDINATE EXACT LOCATION OF AV RACK RECEPTACLE WITH TECHNOLOGY (T-SERIES) DRAWINGS PRIOR TO ROUGH IN AND MAKE FINAL CONNECTION.

ELECTRICAL KEYED NOTES	
#	Description
10	PROVIDE RECEPTACLE FOR OSCILLATING FAN. COORDINATE EXACT MOUNTING HEIGHT WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN AND MAKE FINAL CONNECTION.
11	PROVIDE JUNCTION BOX FOR OSCILLATING FAN CONTROLLER. COORDINATE EXACT LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN AND MAKE FINAL CONNECTION.
12	VARIABLE FREQUENCY DRIVE MOTOR CONTROLLER, PROVIDE BY DIVISION 23, INSTALLED BY DIVISION 26

GENERAL NOTES	
1	ELECTRICAL CONTRACTOR SHALL PROVIDE A 120-VOLT CONNECTION TO ALL VAV UNITS VIA LOW VOLTAGE TRANSFORMER PROVIDED WITH UNIT. PROVIDE 2#12, #12S, 3/4". TO NEAREST CONVENIENCE RECEPTACLE. NOT TO EXCEED 15-AMPS. COORDINATE EXACT LOCATION WITH DIVISION 23 AND MAKE FINAL CONNECTION.

- MAINTENANCE BAY 143 - SHALL COMPLY WITH THE FOLLOWING:
CLASSIFICATION: HAZARDOUS LOCATION: MAJOR REPAIR GARAGE
NON-VENTILATED, CLASS I, DIVISION II.
- CLASS I DIVISION II - CLASSIFIED AREA EXTEND FROM FINISHED FLOOR TO +18" AFF.
1. MOUNT ALL ELECTRICAL DEVICES AT LEAST 42" AFF UNLESS NOTED OTHERWISE. DEVICES LOCATED +18" OR BELOW SHALL BE RATED INSTALLED PER CLASSIFIED AREA.
 2. PROVIDE VAPOR TIGHT CONDUIT SEALS AS REQUIRED PER NEC 501.15(C)
 3. ALL CONDUIT BELOW 24" AFF SHALL BE RIGID GALVANIZED CONDUIT.
 4. MOUNT THE BOTTOM OF PANEL BOARDS AT MINIMUM OF 30" AFF WITH OPERATOR FOR CIRCUIT BREAKERS, SWITCHES, ETC.. AT MAXIMUM OF 78" AFF. PROVIDE ADDITIONAL PANELBOARD SECTIONS AS REQUIRED.
 5. REFER TO NEC 500, 501, 505, 511 FOR ADDITIONAL INFORMATION.



1 ELECTRICAL POWER PLAN - LEVEL 1
Scale: 1/8" = 1'-0"

Salas O'Brien
Houston
10930 W. Sam Houston Pkwy North, Suite 900
Houston, TX 77064
Salas O'Brien Registration: F-4111
Salas O'Brien Project Number: 2022-01042-00

NO.	ISSUE	DATE
	Schematic Design	03/06/2024
	Design Development	05/20/2024
	Owner's Final Review	08/02/2024
	Bids and Construction	08/21/2024
1	ADDENDUM #2	09/23/2024
2	ADDENDUM #3	10/23/2021

SHEET NUMBER:
E300

SHEET NAME:
**ELECTRICAL
POWER FLOOR
PLAN**

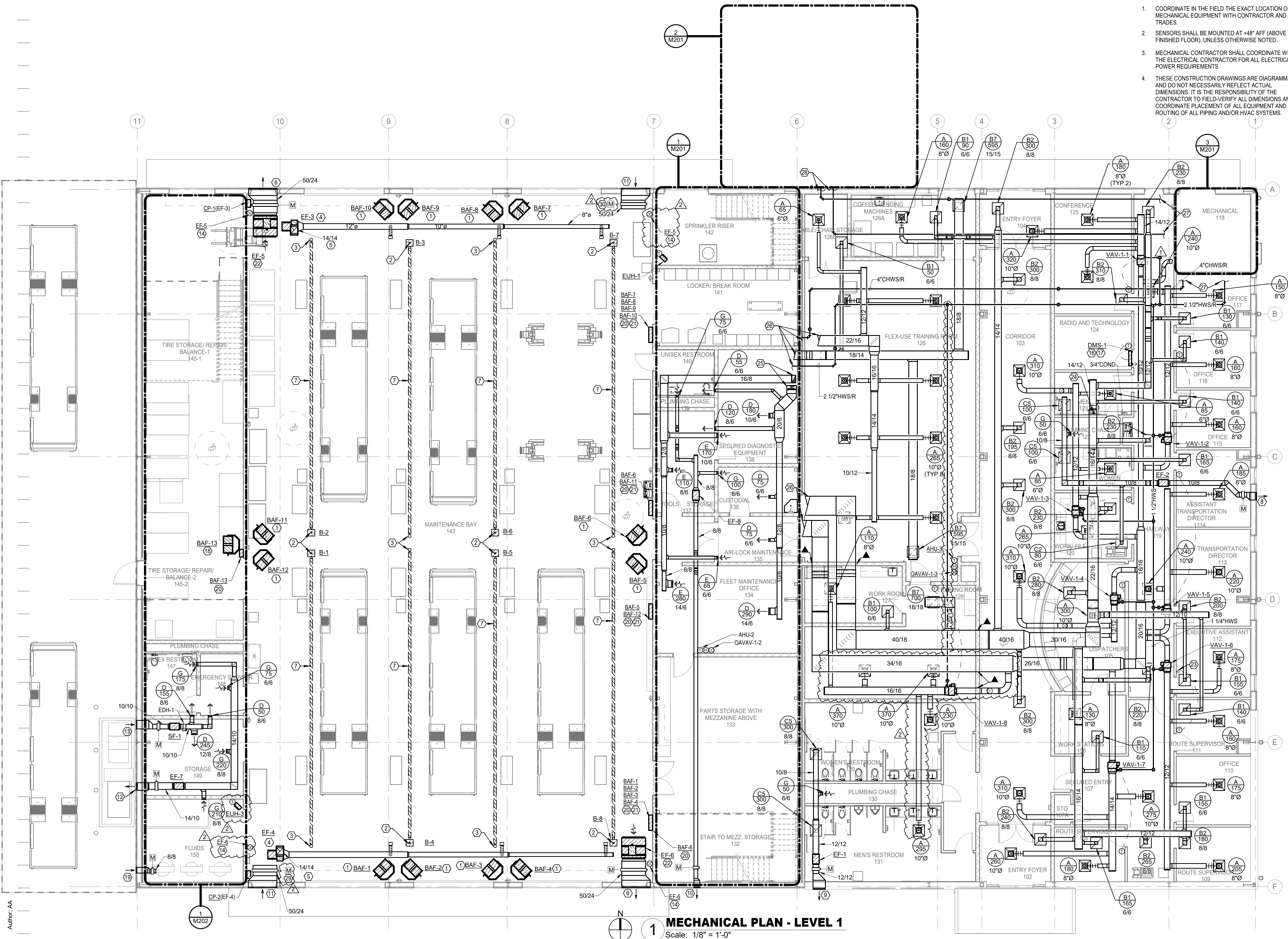
SCALE:
1/8" = 1'-0"

PROJECT NUMBER:
23042

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Bradley Kalmans
80219
Professional Engineer
09.23.24

BUS PARKING AND MAINTENANCE FACILITY
Beaumont Independent School District
2445 Concord Road, Beaumont, Texas 77703



MECHANICAL GENERAL NOTES:

1. COORDINATE IN THE FIELD THE EXACT LOCATION OF MECHANICAL EQUIPMENT WITH CONTRACTOR AND ALL TRADES.
2. SENSORS SHALL BE MOUNTED AT +48" AFF (ABOVE FINISHED FLOOR), UNLESS OTHERWISE NOTED.
3. MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR ALL ELECTRICAL POWER REQUIREMENTS.
4. THESE CONSTRUCTION DRAWINGS ARE DIAGRAMMATIC AND DO NOT NECESSARILY REFLECT ACTUAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD-VERIFY ALL DIMENSIONS AND COORDINATE PLACEMENT OF ALL EQUIPMENT AND ROUTING OF ALL PIPING AND/OR HVAC SYSTEMS.

MECHANICAL KEYED NOTES

- 1 OSCILLATING AIR CIRCULATOR FAN. REFER TO FAN SPECIFICATION SECTION FOR MORE INFORMATION.
- 2 ROUTE 4" FRESH AIR INTAKE DUCT UP THROUGH ROOF TO GOOSENECK WITH BIRDSCREEN.
- 3 ROUTE 4" FLUE UP THROUGH ROOF TO WEATHER PROOF VENT CAP WITH REQUIRED BAND CLAMP AND BIRDSCREEN.
- 4 VEHICLE EXHAUST FAN SHALL BE SUSPENDED WITH UNISTRUT RUNNERS AND PLATFORM SECURED TO STRUCTURE WITH HANGER RODS.
- 5 ROUTE EXHAUST AIR DUCTWORK AT SIZE SHOWN UP FROM VEHICLE EXHAUST FAN OUTLET THROUGH ROOF TO RELIEF VENT.
- 6 PROVIDE 60" X 42" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT EXHAUST AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 9.27 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 17' 10" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 7 TUBE AND REFLECTOR ASSEMBLY SHALL BE HUNG FROM STRUCTURE UTILIZING A 3/8" ALL THREAD ROD, TURNBUCKLES AND MANUFACTURERS TUBE HANGERS.
- 8 PROVIDE 16" X 12" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT EXHAUST AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.41 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 11' 1" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 9 PROVIDE 16" X 14" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT EXHAUST AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 1.52 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 10' 11" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 10 PROVIDE 12" X 12" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT EXHAUST AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.81 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 8' 2" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 11 PROVIDE 60" X 42" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT OUTSIDE AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 9.27 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 17' 10" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 12 PROVIDE 16" X 16" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT EXHAUST AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.58 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 7' 9" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 13 PROVIDE 16" X 16" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT OUTSIDE AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.69 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 8' 10" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 14 PROVIDE CARBON MONOXIDE MONITORING STATION. MOUNT ENCLOSURE 50" AFF PER MANUFACTURER RECOMMENDATION. REFER TO SPECIFICATION FOR MORE INFORMATION.
- 15 ROUTE CONDENSATE PIPE AT SIZE INDICATED TO WYE TAIL PIECE. REFER TO PLUMBING DRAWINGS.
- 16 VERIFY SERVICE CLEARANCES FOR AIR FILTER, FAN SHAFT AND W/ REMOVAL WITH EQUIPMENT MANUFACTURER. COORDINATE WITH ALL TRADES NOT TO OBSTRUCT.
- 17 ROUTE REFRIGERANT LINES TO ASSOCIATED CONDENSING UNIT ON GROUND. SIZE LINES PER MANUFACTURER'S RECOMMENDATION.
- 18 PROVIDE WALL MOUNTED OSCILLATING FAN REFER TO SCHEDULES AND SPECIFICATION FOR MORE INFORMATION.
- 19 PROVIDE 12" X 10" RUSKIN MODEL H2700MD WIND-DRIVEN RAIN RESISTANT OUTSIDE AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.22 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. BOTTOM OF LOUVER 8' 10" A.F.F. COORDINATE FINAL LOCATION WITH ARCHITECT.
- 20 PROVIDE LABEL ON SWITCHES AND CONTROLLERS TO ASSOCIATED EQUIPMENT.
- 21 PROVIDE MULTI-FAN CONTROLLER.
- 22 FAN SHALL BE INSTALLED TIGHT TO BOTTOM OF STRUCTURE.
- 23 PROVIDE EMERGENCY MUSHROOM STYLE PUSH/PULL STATION HVAC SHUTDOWN SWITCH WITH CLEAR COVER. COORDINATE FINAL LOCATION WITH THE OWNER.
- 24 ROUTE FLUE FLUE SIZE CONDENSATE PIPE TO WYE TAIL PIECE. REFER TO PLUMBING DRAWINGS FOR EXACT LOCATION.
- 25 ROUTE DUCT UP THROUGH MEZZANINE FLOOR AT SIZE INDICATED AND PROVIDE FIRE DAMPER. RE: 1/M201 FOR CONTINUATION.
- 26 RE: 1/M201 FOR CONTINUATION.
- 27 RE: 3/M201 FOR CONTINUATION.
- 28 RE: 2/M201 FOR CONTINUATION.
- 29 INTERLOCK WITH EF-5.
- 30 INTERLOCK WITH EF-6.

NO.	ISSUE	DATE
	Schematic Design	03/06/2024
	Design Development	05/20/2024
	Owner's Final Review	08/02/2024
	Bids and Construction	08/21/2024
1	ADDENDUM #2	09/23/2024
2	ADDENDUM #3	10/23/2021

SHEET NUMBER:

M101

SHEET NAME:

MECHANICAL
FLOOR PLAN

SCALE:

As indicated

PROJECT NUMBER:

23042



BUS PARKING AND MAINTENANCE FACILITY

Beaumont Independent School District
2445 Concord Road, Beaumont, Texas 77703

BUS PARKING AND MAINTENANCE FACILITY

Beaumont Independent School District
2445 Concord Road, Beaumont, Texas 77703

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2	ADDENDUM #3	10/23/2021

SHEET NUMBER:
M201

SHEET NAME:
MECHANICAL ENLARGED PLAN

SCALE:
As indicated

PROJECT NUMBER:
23042

Salas O'Brien
Houston
10930 W. Sam Houston Pkwy North, Suite 900
Houston, TX 77064
Salas O'Brien Registration: F-4111
Salas O'Brien Project Number: 2022-01042-00

MECHANICAL GENERAL NOTES:

- COORDINATE IN THE FIELD THE EXACT LOCATION OF MECHANICAL EQUIPMENT WITH CONTRACTOR AND ALL TRADES.
- SENSORS SHALL BE MOUNTED AT +48" AFF (ABOVE FINISHED FLOOR), UNLESS OTHERWISE NOTED.
- MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR ALL ELECTRICAL POWER REQUIREMENTS.
- THESE CONSTRUCTION DRAWINGS ARE DIAGRAMMATIC AND DO NOT NECESSARILY REFLECT ACTUAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD-VERIFY ALL DIMENSIONS AND COORDINATE PLACEMENT OF ALL EQUIPMENT AND ROUTING OF ALL PIPING AND/OR HVAC SYSTEMS.

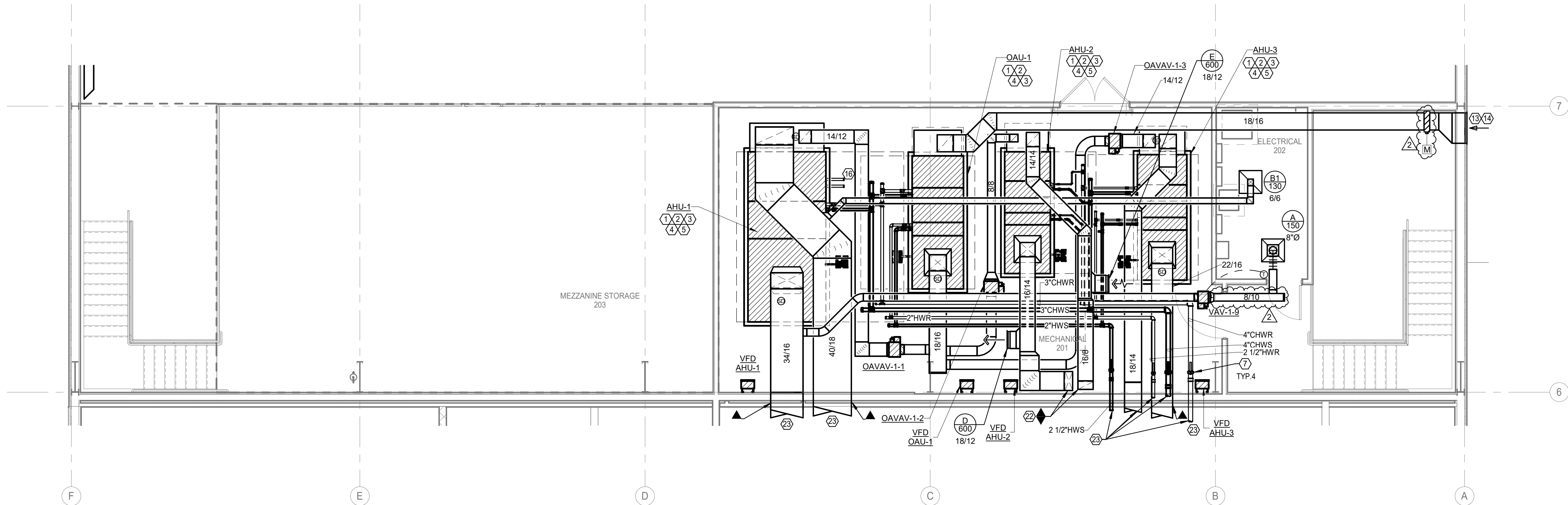
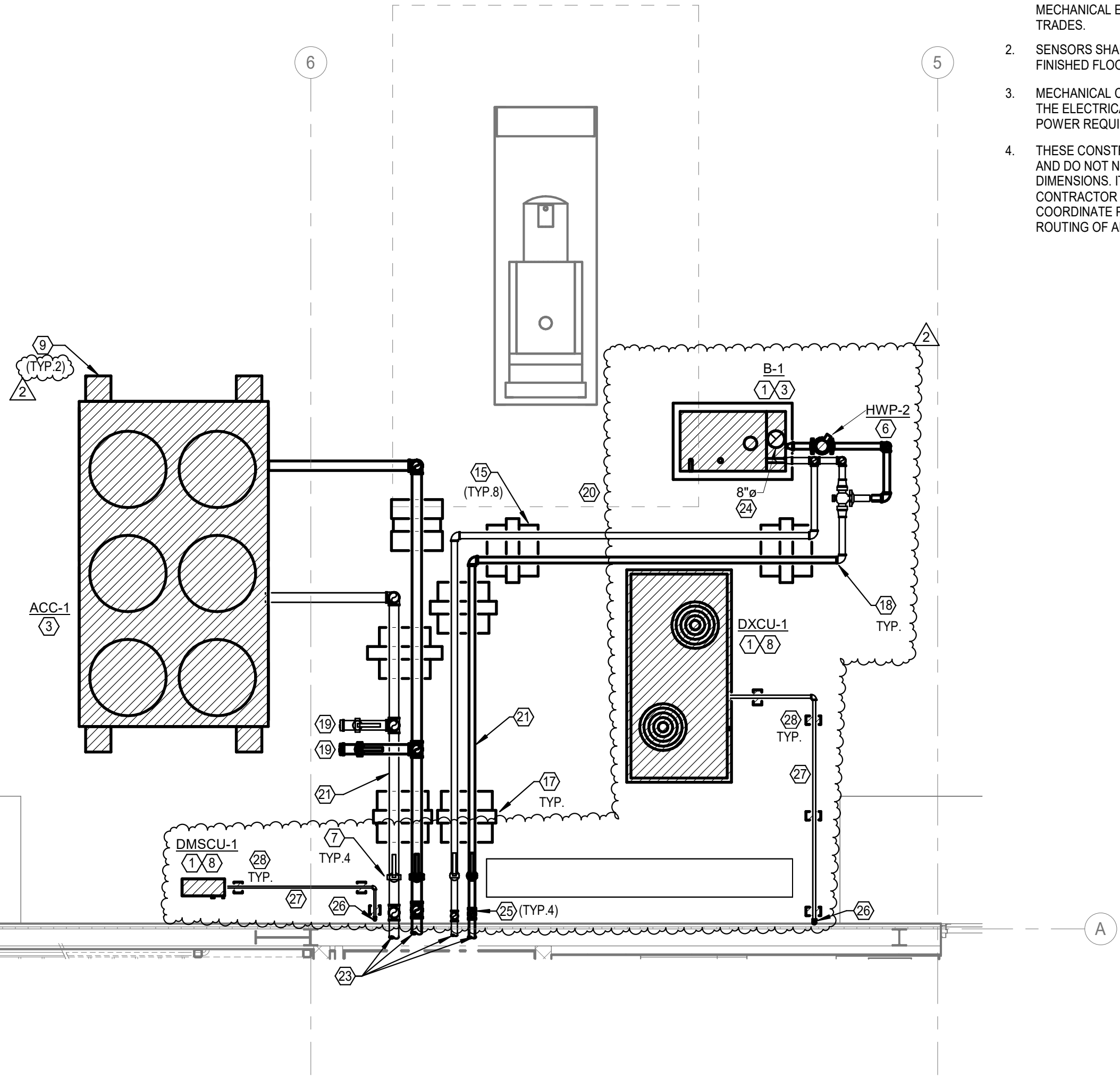
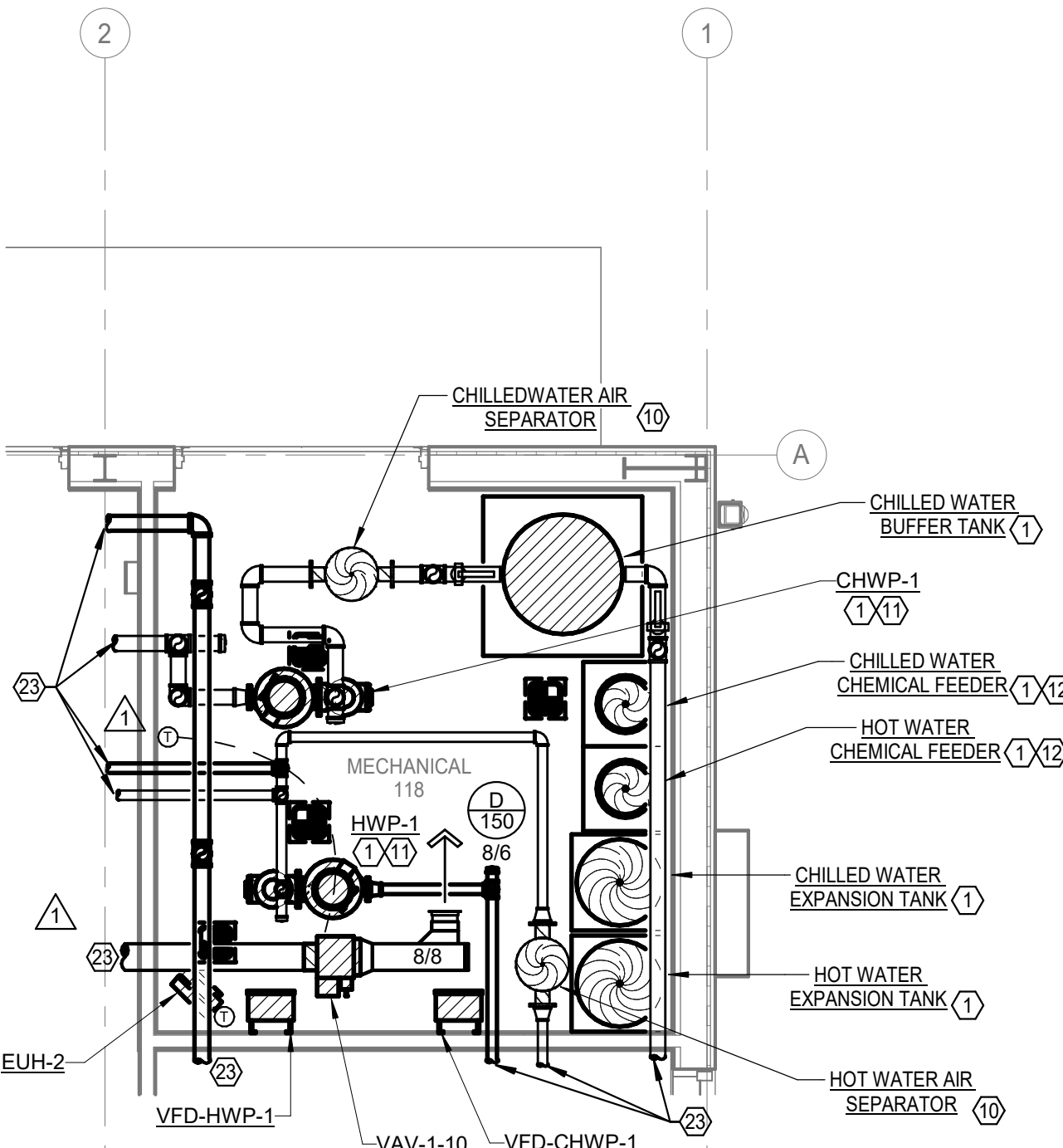
MECHANICAL KEYED NOTES

- PROVIDE 4" THICK CONCRETE HOUSEKEEPING PAD.
- ROUTE FULL SIZE CONDENSATE DRAIN PIPING TO FLOOR SINK (SEE PLUMBING DRAWING FOR EXACT LOCATION). INSTALL CONDENSATE TRAP AS RECOMMENDED PER MANUFACTURER.
- VERIFY SERVICE CLEARANCES FOR AIR FILTER, FAN SHAFT AND COIL REMOVAL WITH EQUIPMENT MANUFACTURER. COORDINATE WITH ALL TRADES NOT TO OBSTRUCT.
- REFER TO DETAILS FOR AHU COIL PIPING.
- PROVIDE FULL SIZE PLENUM AT RETURN AIR INLET FOR AHU AS SHOWN AND INSTALL TEMPERATURE SENSOR.
- CIRCULATOR PUMP PROVIDED BY BOILER MANUFACTURER.
- PROVIDE ISOLATION VALVE.
- ROUTE REFRIGERANT PIPING TO ASSOCIATED INDOOR UNIT.
- PROVIDE 12"x12" CONCRETE RUNNERS TO SPAN LENGTH OF AIR COOLED CHILLER.
- RE: 1M400 FOR SUPPORT AT AIR SEPARATOR.
- VERIFY SERVICE AND AIRFLOW CLEARANCE WITH EQUIPMENT MANUFACTURER. COORDINATE WITH ALL TRADES NOT TO OBSTRUCT.
- RE: 4M400 FOR CHEMICAL FEEDER TANK SUPPORT.
- PROVIDE 32"x20" RUSKIN MODEL 427000 WIND-DRIVEN RAIN RESISTANT OUTSIDE AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 1.78 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. COORDINATE FINAL LOCATION WITH ARCHITECT.
- PROVIDE DUCTWORK AT FULL SIZE OF LOUVER.
- PROVIDE PIPE STAND FOR SUPPORT OF PIPE RE: 4M401 FOR DETAILS.
- REFRIGERANT LINES TO ASSOCIATED AIR COOLED CONDENSING UNIT ON GROUND.
- RE: 1M301 FOR CHILLED WATER PIPE SIZES ON PIPING DIAGRAM.
- RE: 1M302 FOR HOT WATER PIPE SIZES ON PIPING DIAGRAM.
- PROVIDE ISOLATION VALVE AND BLIND FLANGE FOR TEMPORARY CONNECTION.
- PROVIDE WITH 3-WAY MIXING VALVE AT LOCATION SHOWN.
- BOTTOM OF ALL PIPING IN THE CHILLER YARD TO BE MINIMUM 7' 0" ABOVE GRADE.
- ROUTE DUCT DOWN THROUGH MEZZANINE FLOOR AT SIZE INDICATED AND PROVIDE FIRE DAMPER. RE: 1M101 FOR CONTINUATION.
- RE: 1M101 FOR CONTINUATION.
- PROVIDE STAINLESS STEEL BOILER FLUE AT SIZE INDICATED. REFER TO SPECIFICATIONS. FLUE SHALL TERMINATE 7'-0" ABOVE FINISHED FLOOR (A.F.F.). SUPPORT BOILER FLUE AS RECOMMENDED BY THE MANUFACTURER. PROVIDE FLUE TERMINATION AS RECOMMENDED BY MANUFACTURER.
- PROVIDE SUPPORT FOR VERTICAL PIPING ON EXTERIOR WALL, WITH HOT DIPPED GALVANIZED UNISTRUT AND HOT DIPPED GALVANIZED PIPE CLAMPS.
- RE: 10M401 FOR VERTICAL EXTERIOR PIPE MOUNTING DETAIL.
- INSULATE OUTDOOR REFRIGERANT PIPING PER SPECIFICATION.
- PROVIDE PHP PIPE SUPPORT AND ATTACH TO CONCRETE SLAB WITH STRUT CLAMPS.

3 MECHANICAL ENLARGED PLAN - LEVEL 1 - MECHANICAL ROOM
Scale: 1/4" = 1'-0"

2 MECHANICAL ENLARGED PLAN - MECHANICAL YARD AND CENTRAL PLANT
Scale: 1/4" = 1'-0"

1 MECHANICAL PLAN - MEZZANINE
Scale: 3/16" = 1'-0"



AAI

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Bradley Kalmans

BRADLEY KALMANS

80219

PROFESSIONAL ENGINEER

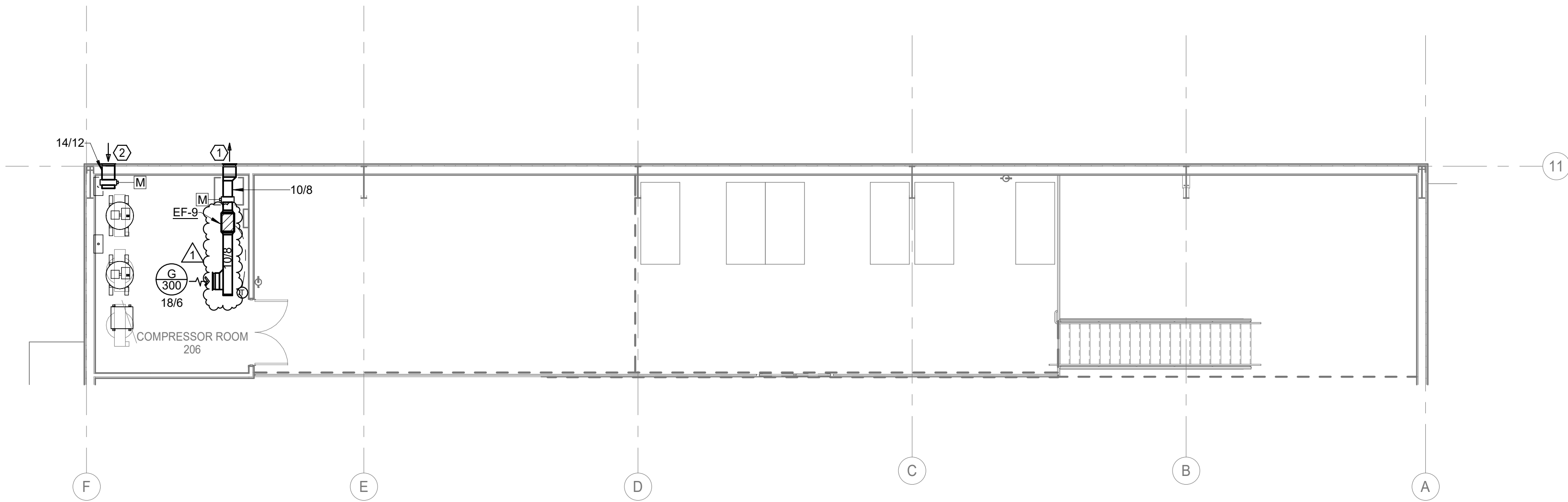
10.23.24

MECHANICAL GENERAL NOTES:

1. COORDINATE IN THE FIELD THE EXACT LOCATION OF MECHANICAL EQUIPMENT WITH CONTRACTOR AND ALL TRADES.
2. SENSORS SHALL BE MOUNTED AT +48" AFF (ABOVE FINISHED FLOOR). UNLESS OTHERWISE NOTED.
3. MECHANICAL CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR ALL ELECTRICAL POWER REQUIREMENTS.
4. THESE CONSTRUCTION DRAWINGS ARE DIAGRAMMATIC AND DO NOT NECESSARILY REFLECT ACTUAL DIMENSIONS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD-VERIFY ALL DIMENSIONS AND COORDINATE PLACEMENT OF ALL EQUIPMENT AND ROUTING OF ALL PIPING AND/OR HVAC SYSTEMS.

MECHANICAL KEYED NOTES

- ① PROVIDE 14"X 12" RUSKIN MODEL HZ700MD WIND-DRIVEN RAIN RESISTANT EXHAUST AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.33 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. COORDINATE FINAL LOCATION WITH ARCHITECT.
- ② PROVIDE 14"X 12" RUSKIN MODEL HZ700MD WIND-DRIVEN RAIN RESISTANT OUTSIDE AIR STATIONARY LOUVER OR APPROVED EQUAL WITH MINIMUM FREE AREA OF 0.33 SQ. FT. PROVIDE WITH BIRD SCREEN AND PAINT TO MATCH WALL OR AS SPECIFIED BY ARCHITECT. COORDINATE FINAL LOCATION WITH ARCHITECT.



MECHANICAL PLAN - LEVEL 2 - COMPRESSOR ROOM
Scale: 1/8" = 1'-0"

BUS PARKING AND MAINTENANCE FACILITY

Beaumont Independent School District
2445 Concord Road, Beaumont, Texas 77703

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5	ADDENDUM #3	10/23/2021
6		
7		
8		
9		
10		

SHEET NUMBER:
M202

SHEET NAME:
**MECHANICAL
ENLARGED PLAN**

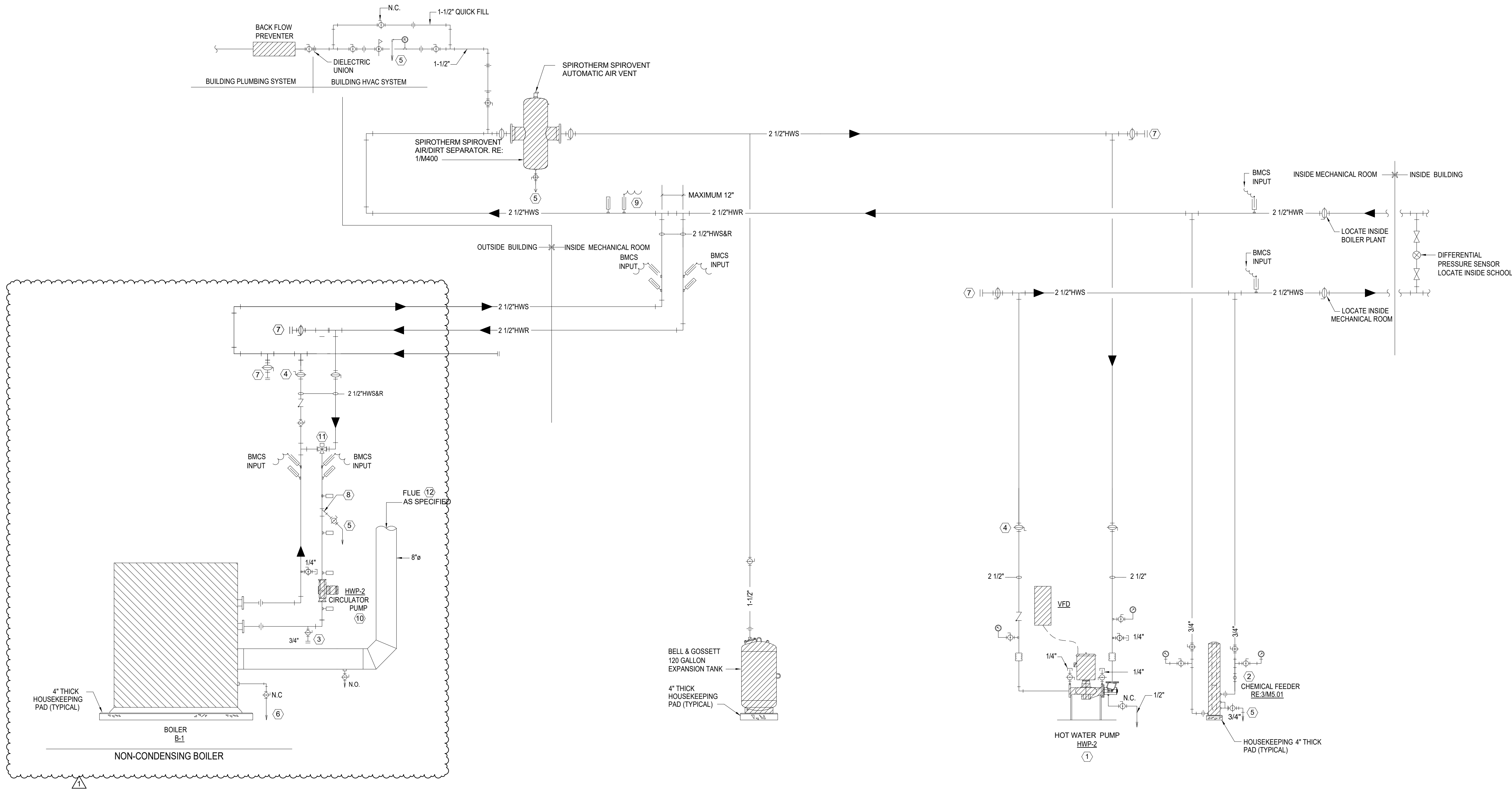
SCALE:
As indicated
PROJECT NUMBER:
23042

Salas O'Brien

Houston
10930 W. Sam Houston Pkwy North, Suite 900
Houston, TX 77064
Salas O'Brien Registration: F-4111
Salas O'Brien Project Number: 2022-01042-00

MECHANICAL KEYED NOTES

- VERTICAL INLINE PUMP. REFER TO 10/M5.01 FOR ADDITIONAL INFORMATION.
- PROVIDE AN ERNEST GAUGE #E-57-3 BRONZE BODY SIGHT GLASS WITH S.S. SHAFT, PLASTIC SPINNER AND DOUBLE WINDOW. OPERATING TEMPERATURE AND PRESSURE SHALL BE 200°F, 125 PSI MINIMUM.
- PROVIDE BALL VALVE WITH HOSE THREAD ADAPTER AT FULL SIZE OR AT SIZE INDICATED.
- BALANCING VALVE TO BE PROVIDED WITH INFINITE POSITION CRANK OR MEMORY STOP FOR BALANCING SERVICE.
- ROUTE FULL SIZE TYPE "L" COPPER DRAIN TO NEAREST FLOOR DRAIN.
- ROUTE FULL SIZE CPVC PIPING FROM BOILER TO ACID NEUTRALIZATION BASIN AND CPVC PIPING FROM BASIN TO FLOOR DRAIN.
- PROVIDE ISOLATION VALVE AND BLIND FLANGE FOR TEMPORARY CONNECTION.
- PROVIDE INLINE STRAINER.
- HEADER TEMPERATURE SENSOR. PROVIDED BY BOILER MANUFACTURER.
- CIRCULATOR PUMP PROVIDED BY BOILER MANUFACTURER.
- 3-WAY THERMOSTATIC MIXING VALVE. PROVIDE WITH BOILER.
- PROVIDE STAINLESS STEEL BOILER FLUE AT SIZE INDICATED. REFER TO SPECIFICATIONS. FLUE SHALL TERMINATE 7'-0" ABOVE FINISHED FLOOR (A.F.F.). SUPPORT BOILER FLUE AS RECOMMENDED BY MANUFACTURER. PROVIDE FLUE TERMINATION AS RECOMMENDED BY MANUFACTURER.



1 HOT WATER PIPING DIAGRAM
SCALE: NO SCALE

NO.	ISSUE	DATE
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	Design Development	05/20/2024
	Owner's Final Review	08/02/2024
	Bids and Construction	08/21/2024
1	ADDENDUM #3	10/23/2021

SHEET NUMBER:
M302

SHEET NAME:
**MECHANICAL
PIPING DIAGRAM**

SCALE:

PROJECT NUMBER:
23042

BUS PARKING AND MAINTENANCE FACILITY

Beaumont Independent School District
2445 Concord Road, Beaumont, Texas 77703

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1	ADDENDUM #3	10/23/2021

SHEET NUMBER:

M401

SHEET NAME:

**MECHANICAL
DETAILS AND
LEGENDS**

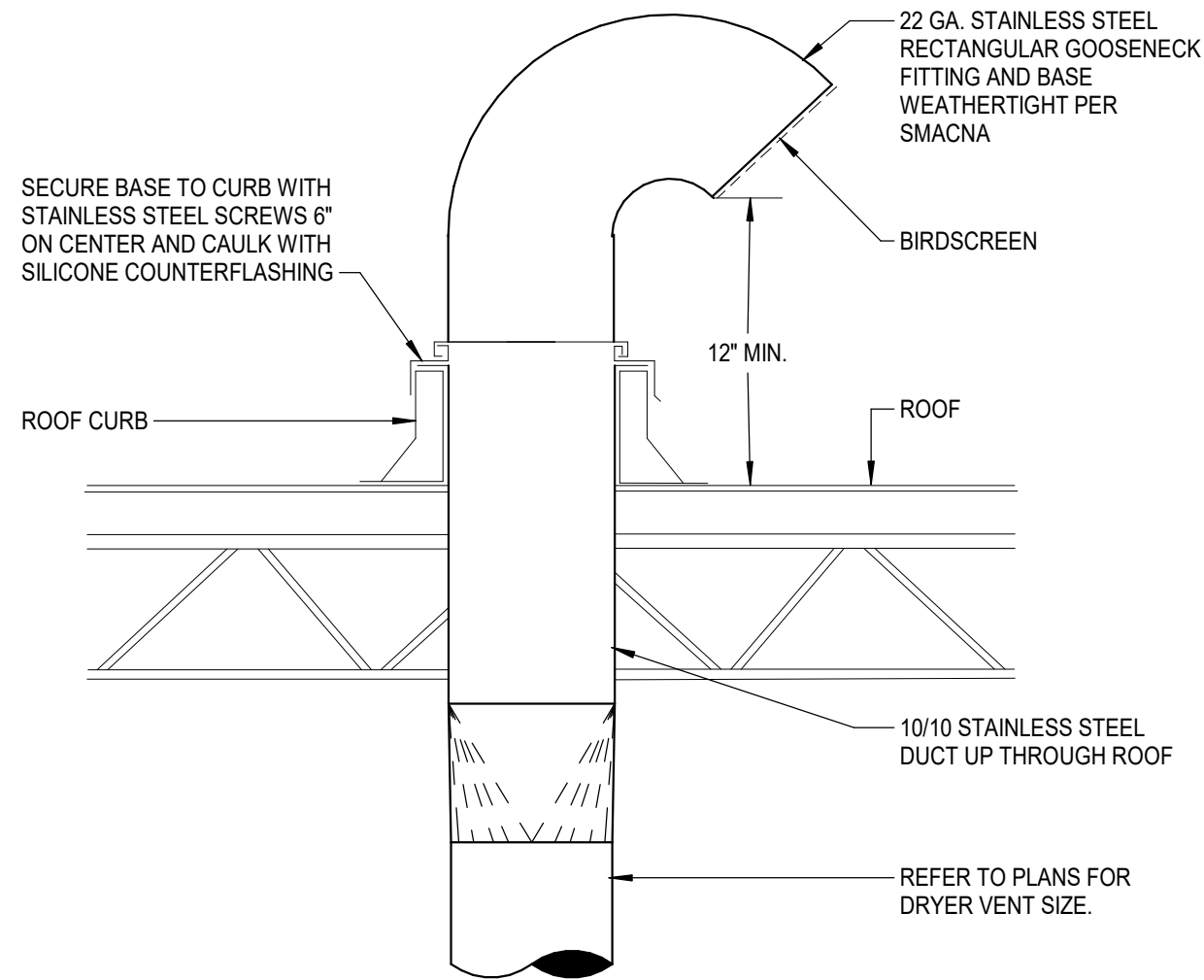
SCALE:

12" = 1'-0"

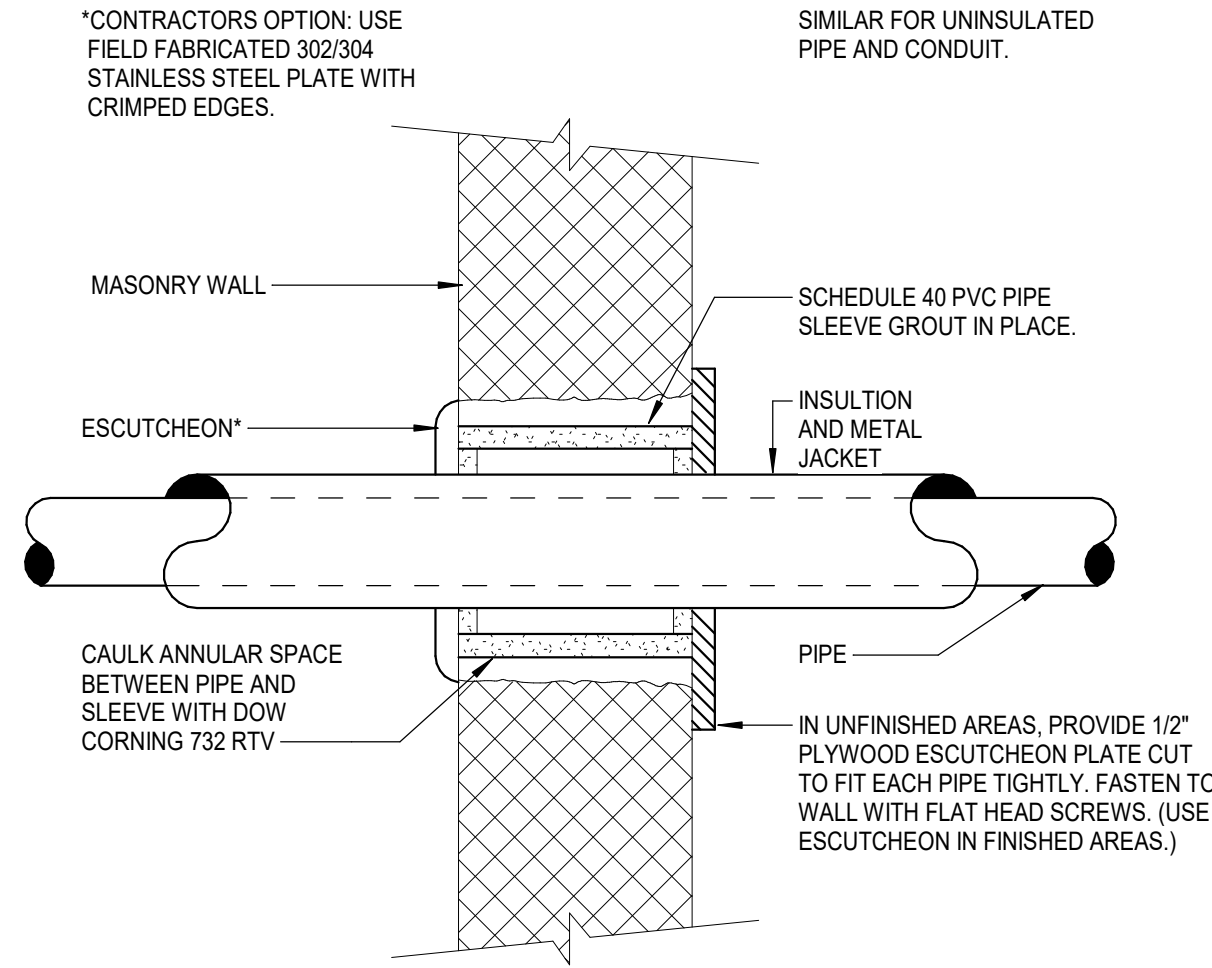
PROJECT NUMBER:

23042

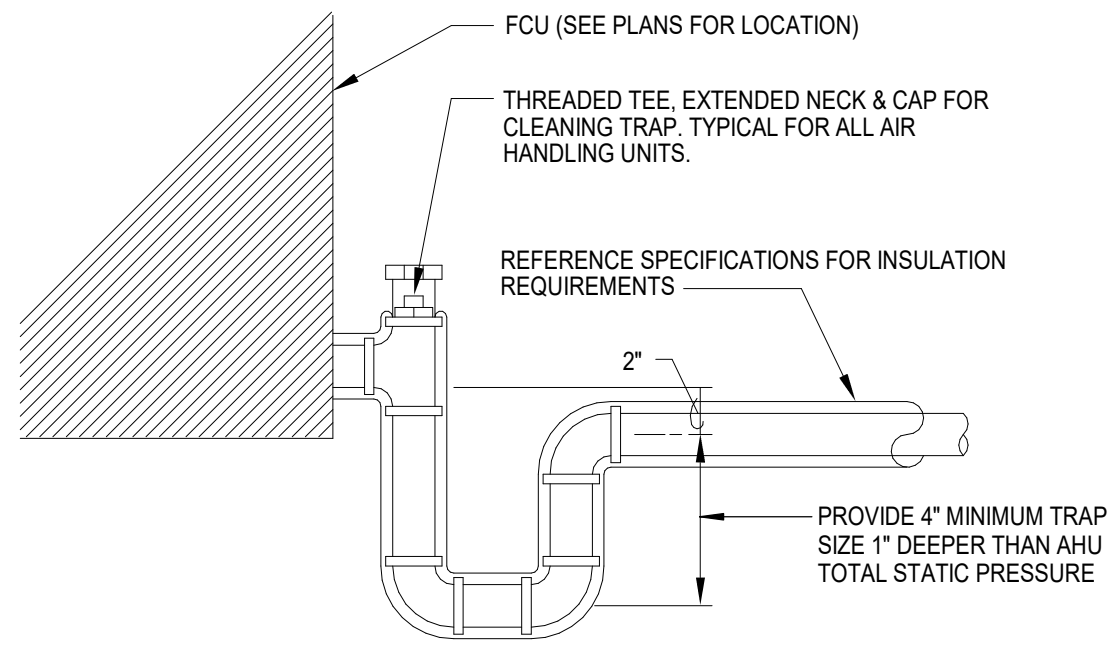
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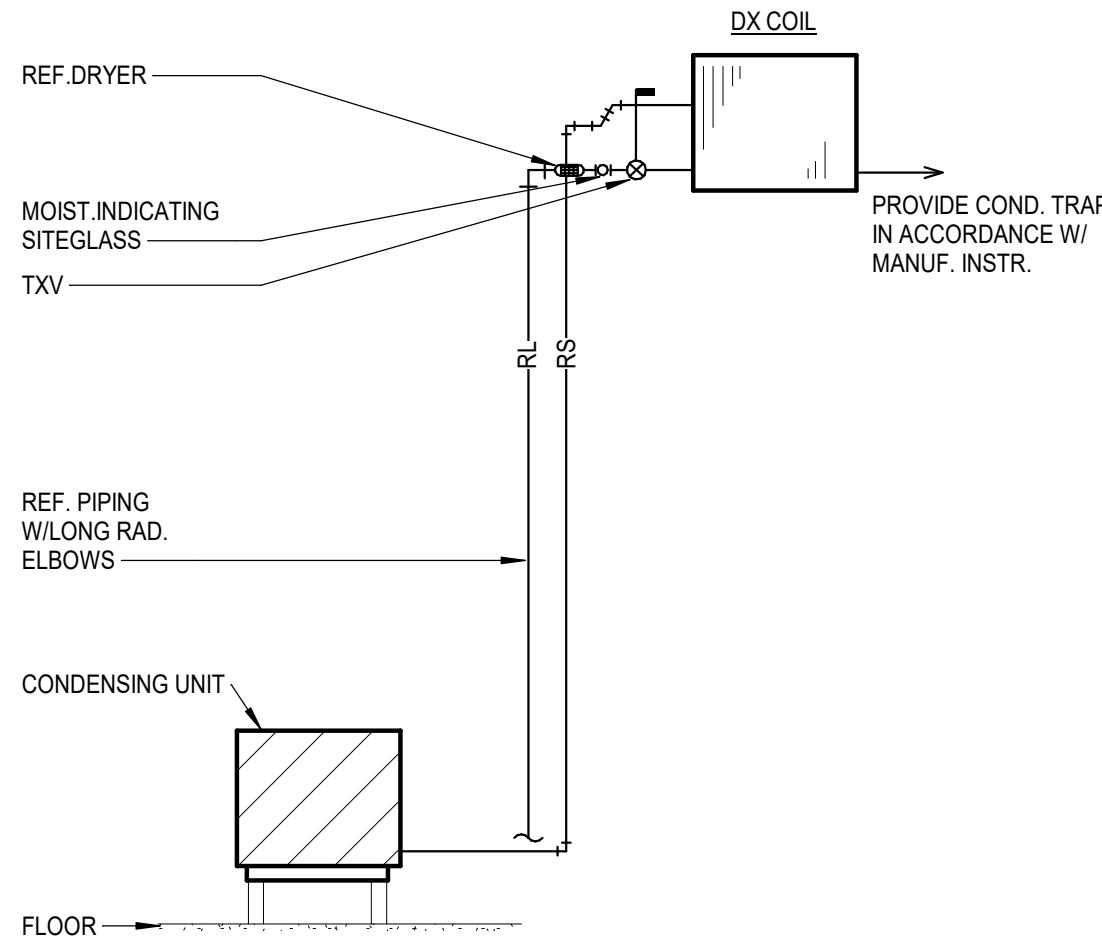
2 VENT THROUGH ROOF
SCALE: NONE



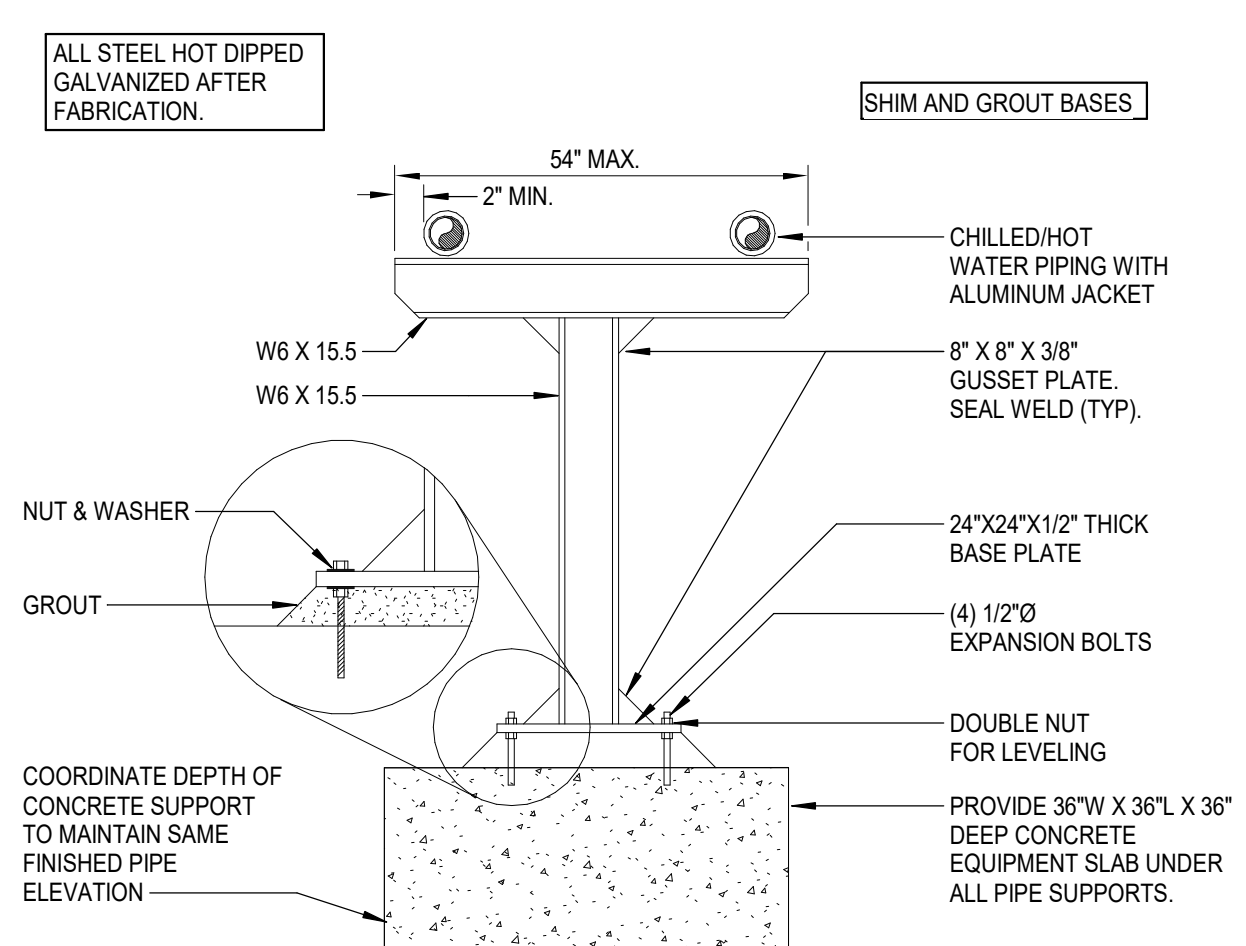
5 PIPE THROUGH EXTERIOR WALL
SCALE: NONE



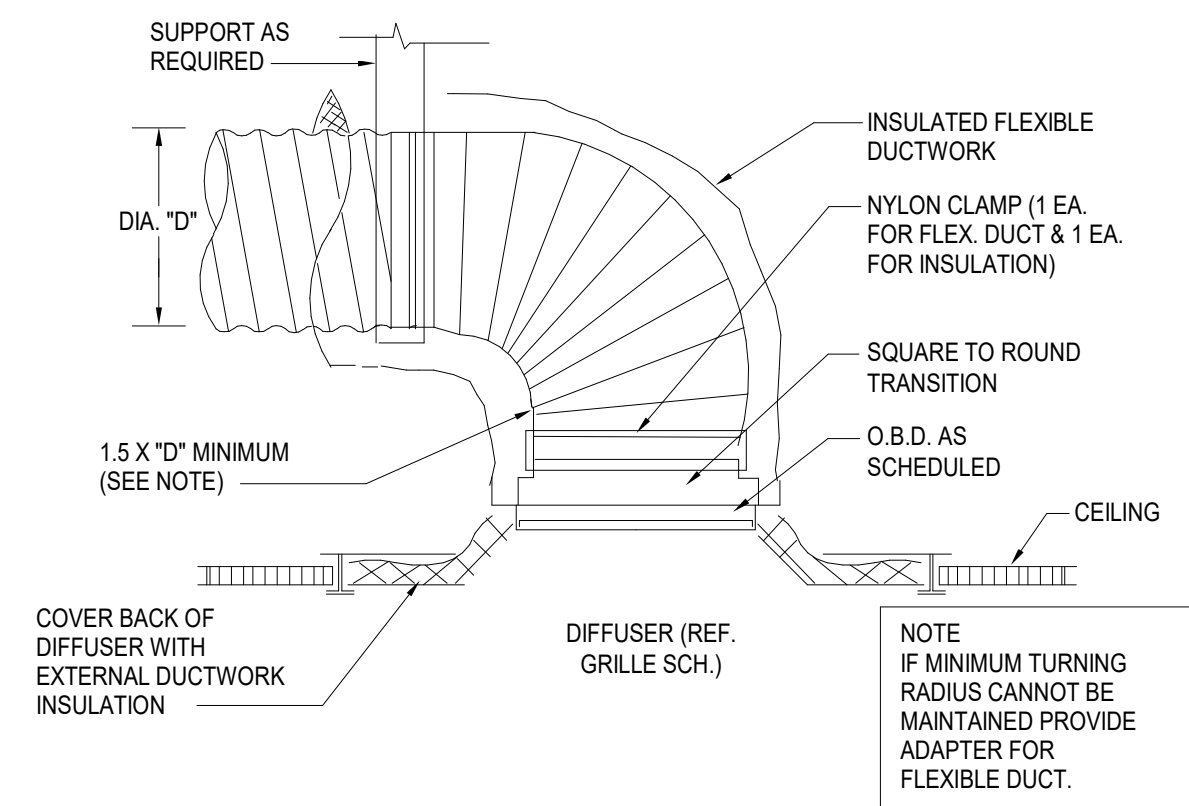
8 CONDENSATE DRAIN PIPING AT FCU
SCALE: NONE



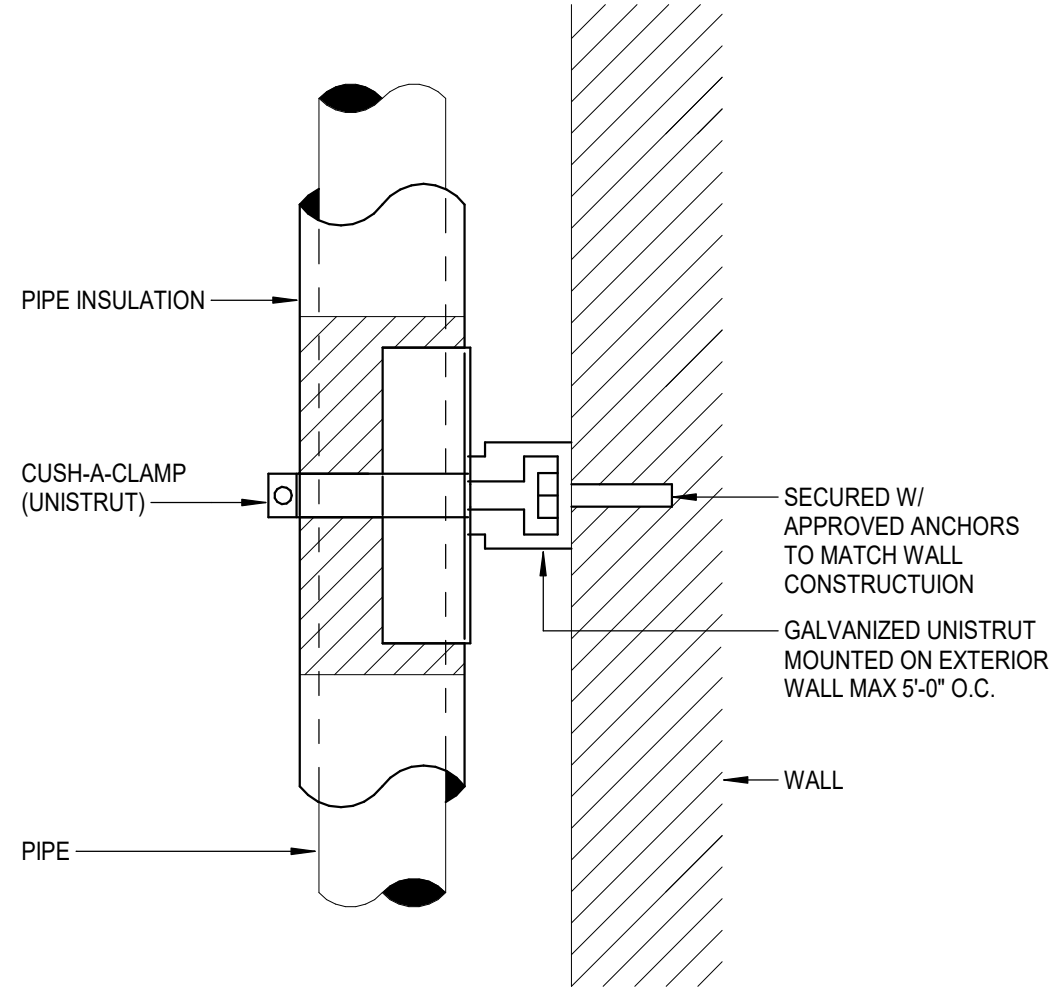
1 REFRIGERANT PIPING DIAGRAM
SCALE: NONE



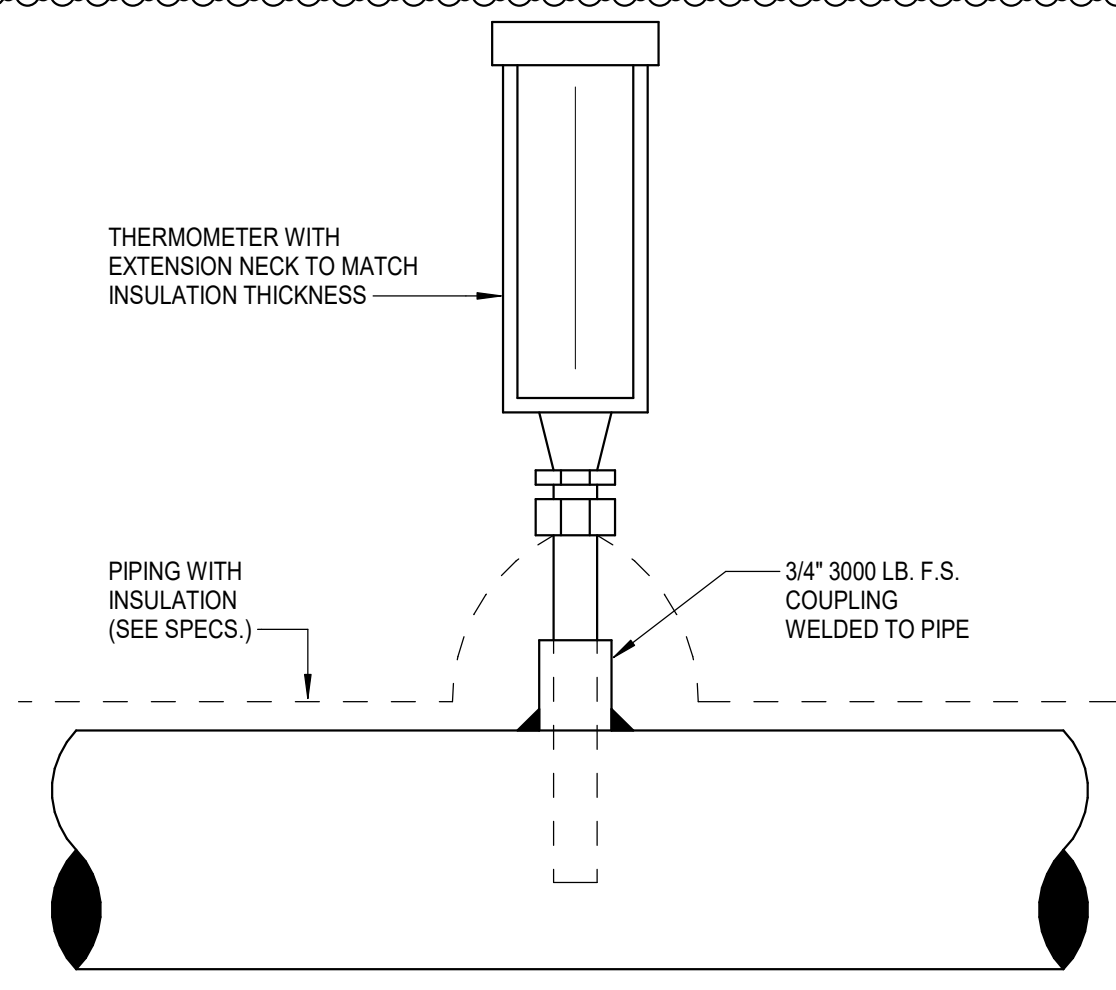
4 PIPE STAND
SCALE: NONE



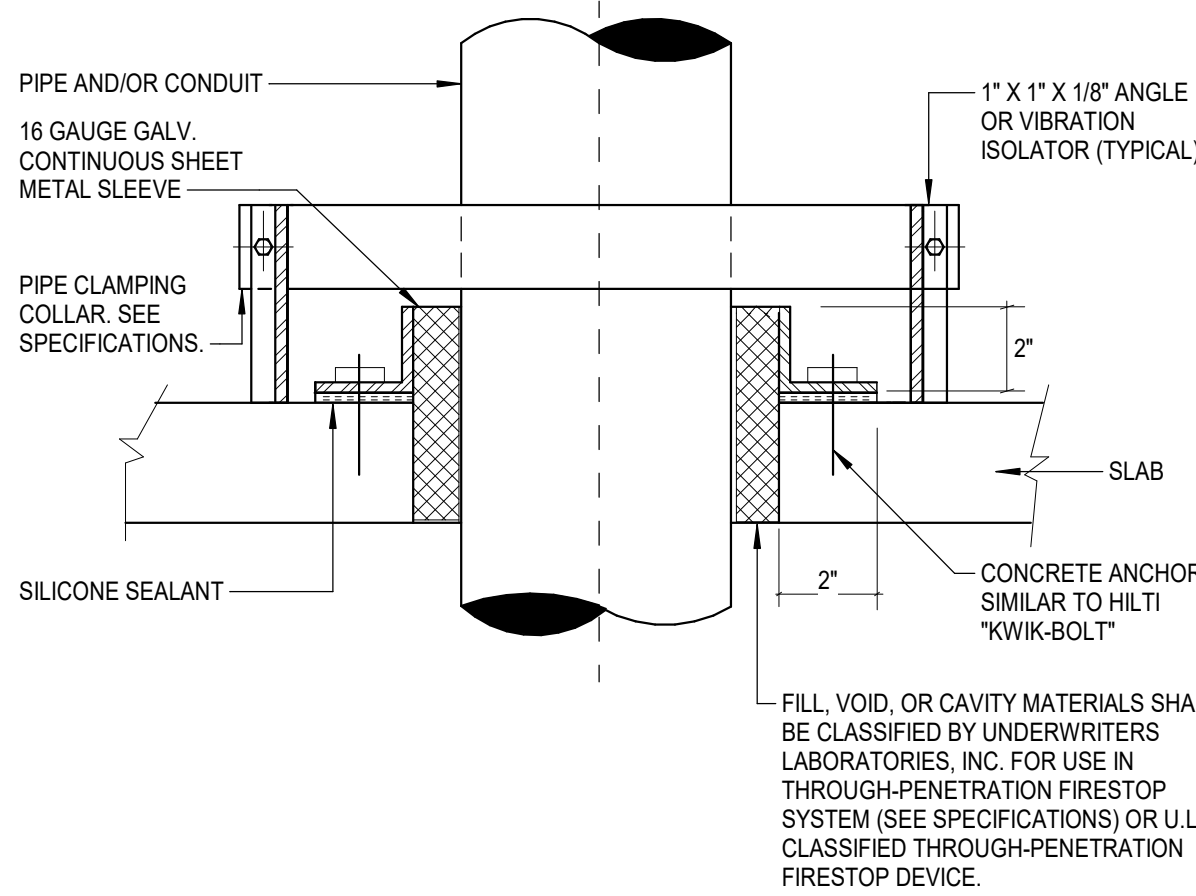
7 FLEX DUCT CONNECTION AT SUPPLY AIR DIFFUSER
SCALE: NONE



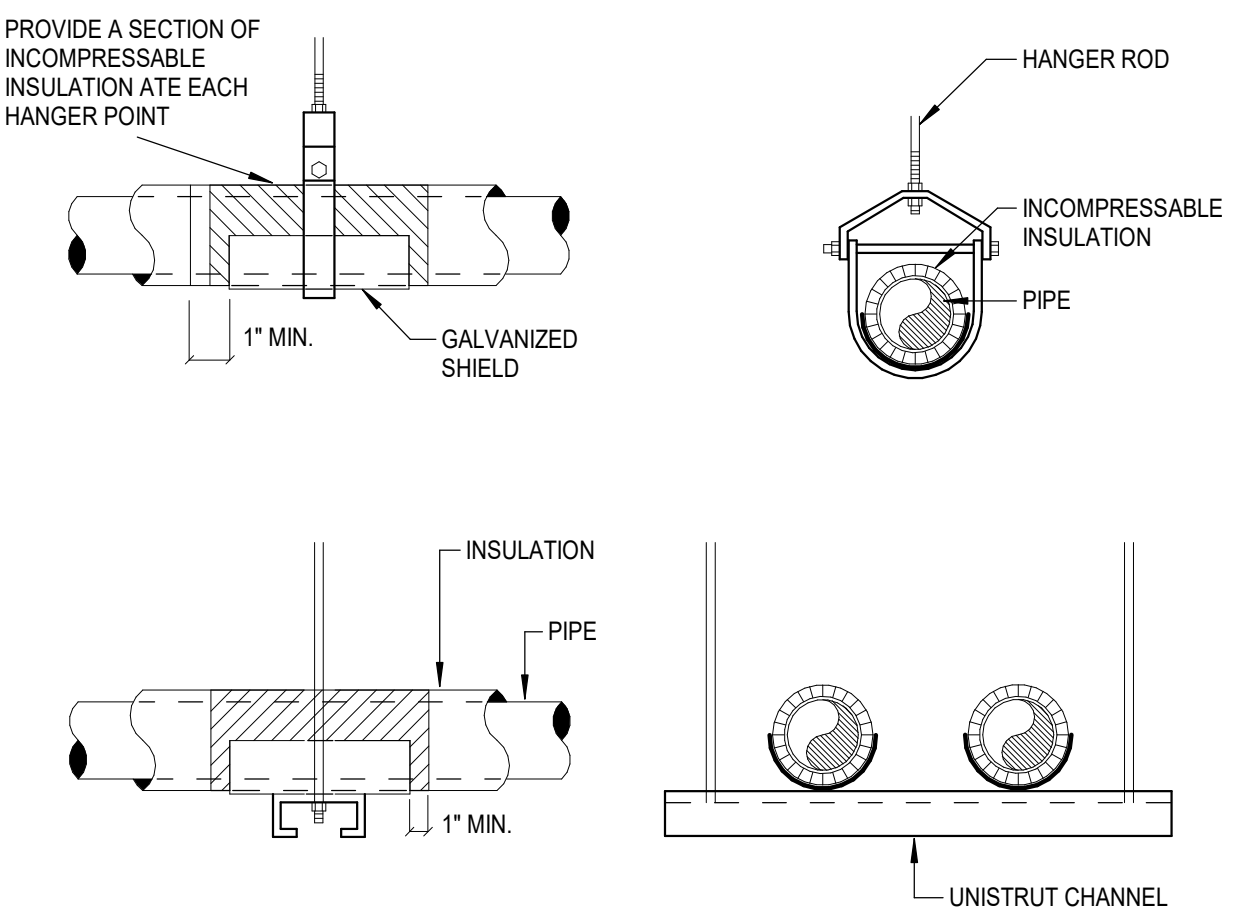
10 EXTERIOR PIPE MOUNTING DETAIL
SCALE: NONE



9 THERMOMETER INSTALLATION
SCALE: NONE



6 PIPE THRU FLOOR
SCALE: NONE



3 PIPE HANGERS
SCALE: NONE

VARIABLE VOLUME TERMINAL BOX							
MARK	MAXIMUM CFM	MINIMUM CFM	INLET DIAMETER SIZE (IN.)	GPM	HOT WATER COIL CONNECTING PIPE SIZE	REMARKS	
OAVAV-1-1	825	260	10	0.0	0"	-	
OAVAV-1-2	190	100	6	0.0	0"	-	
OAVAV-1-3	945	260	10	0.0	0"	-	
VAV-1-1	840	260	10	1.8	3/4"	-	
VAV-1-2	710	260	10	1.5	3/4"	-	
VAV-1-3	745	260	10	1.6	3/4"	-	
VAV-1-4	740	260	10	1.6	3/4"	-	
VAV-1-5	645	180	8	1.4	3/4"	-	
VAV-1-6	715	180	10	1.6	3/4"	-	
VAV-1-7	1,025	360	10	2.2	3/4"	-	
VAV-1-8	1,375	360	12	3.0	3/4"	-	
VAV-1-9	150	150	6	0.0	0"	-	
VAV-1-10	150	150	6	0.0	0"	-	
GENERAL NOTES: 1. MAXIMUM STATIC PRESSURE DROP OF AIR THROUGH THE TERMINAL BOX SHALL BE 0.2" ESP. 2. MAXIMUM VELOCITY THROUGH DUCT INLET SHALL BE 2,000 FPM. 3. MAXIMUM STATIC PRESSURE DROP THROUGH HEATER COIL SHALL BE 0.25" ESP. 4. MAXIMUM STATIC PRESSURE DROP OF WATER THROUGH HEATER COIL SHALL BE 10' W.G. 5. BTUH REQUIRED FOR HOT WATER HEATING IS HEATING GPM MULTIPLIED BY 10,000. 6. SUSPEND UNIT WITH FOUR THREADED HANGER RODS ATTACHED TO TWO UNISTRUT RUNNERS SECURED TO STRUCTURE. REFER TO MANUFACTURER FOR MORE DETAILS. 7. UNITS TO BE MOUNTED BETWEEN BEAMS AND 18" MAXIMUM ABOVE CEILING. AVOID MOUNTING OVER LIGHTS WHEREVER POSSIBLE. 8. REFER TO PIPING AT HOT WATER COIL DETAILS. PROVIDE WITH 2-WAY CONTROL VALVE UNLESS OTHERWISE SCHEDULED.							
REMARKS: 1. N/A							

AIR COOLED CONDENSING UNIT							
MARK	MIN. TOTAL CAPACITY (BTUH)	OUTDOOR AIR TEMP (°F)	MINIMUM EER/ SEER2	CURRENT CHAR. V P F	RELATED UNIT MARK	REMARKS	
DXCU-1	240,524	95	11.0+	480 3 60	AHU-1	1,2,3,4,5	
GENERAL NOTES: A. MINIMUM RECOMMENDED CLEARANCE AROUND UNIT IS 12 INCHES ON NON-SERVICE SIDES AND 30 INCHES ON SERVICE SIDES. MAINTAIN MINIMUM CLEARANCE FOR CONDENSER AIR FLOW AS RECOMMENDED BY UNIT MANUFACTURER. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC. REMARKS: 1. PROVIDE WITH LOW AMBIENT CONTROL DOWN TO 20°F. 2. PROVIDE WITH DISCONNECT SWITCH. 3. REFRIGERANT LINES TO BE SIZED PER MANUFACTURER'S REQUIREMENTS. 4. PROVIDE WITH VARIABLE CAPACITY COMPRESSOR. 5. UNIT IS PART OF A VARIABLE AIR VOLUME SYSTEM AND SHALL BE PROVIDED WITH A MINIMUM OF ONE CIRCUIT WITH A FULLY MODULATING DIGITAL SCROLL OR VARIABLE SPEED SCROLL TYPE COMPRESSOR AS SPECIFIED. UNITS SHALL BE CAPABLE OF MODULATION FROM 10-100% OF ITS CAPACITY AND ALLOW FOR AHU AIRFLOW TURN DOWN TO 30% OF FULL FLOW.							

PUMP										
TAG	SERVICE	TYPE	GPM	HEAD (FT.)	MOTOR HORSE POWER	MAX. RPM	CURRENT CHARAC. V P F	MANUFACTURER	MODEL NUMBER	REMARKS
CHWP-1	CHILLED WATER	VERTICAL INLINE	101	90.00	5.00	1750	480 3 60	ARMSTRONG	4300	1,2,3
HWP-1	HEATING HOT WATER	VERTICAL INLINE	43	80.00	3.00	1750	480 3 60	ARMSTRONG	4300	1,2,3
HWP-2	HEATING HOT WATER	INLINE CIRCULATOR	43	15.00	0.50	1750	120 1 60	ARMSTRONG	4300	3,4
GENERAL NOTES: 1. PUMP IS TO HAVE A NON-OVERLOADING MOTOR. 2. MINIMUM RECOMMENDED CLEARANCE AROUND A PUMP IS 24 INCHES. MAINTAIN MINIMUM CLEARANCES AS REQUIRED FOR SERVICE, MAINTENANCE, AND INSPECTION. REMARKS: 1. PROVIDE WITH VARIABLE FREQUENCY DRIVE. 2. PROVIDE SUCTION DIFFUSER AT PUMP INLET. 3. PROVIDE PUMP WITH GAUGE TAPS. 4. PUMP SHALL BE PROVIDED BY BOILER MANUFACTURER.										

DUCTLESS MINI-SPLIT - OUTDOOR UNIT										
MARK	MIN. TOTAL CAPACITY (BTUH)	OUTDOOR AIR TEMP (°F)	MINIMUM EER/ SEER	CURRENT CHARAC. V PH F	RELATED UNIT MARK	REMARKS				
DMSCU-1	17,100	95	-15.2	208 1 60	DMS-1	1,2,3				
GENERAL NOTES: 1. MINIMUM RECOMMENDED CLEARANCE AROUND ROOFTOP UNIT IS 12 INCHES ON NON-SERVICE SIDES AND 30 INCHES ON SERVICE SIDES. MAINTAIN MINIMUM CLEARANCE FOR CONDENSER AIR FLOW AS RECOMMENDED BY UNIT MANUFACTURER. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC. REMARKS: 1. PROVIDE WITH LOW AMBIENT CONTROL DOWN TO 20°F. 2. PROVIDE WITH DISCONNECT SWITCH. 3. REFRIGERANT LINES TO BE SIZED PER MANUFACTURER'S REQUIREMENTS.										

PACKAGED AIR COOLED SCROLL CHILLER										
MARK	ACTUAL CAPACITY (TONS)	LEAVING WATER TEMP (°F)	GPM	PRESSURE DROP (FT.)	AMBIENT AIR TEMP. (°F)	CURRENT CHARAC. V P F	BASIS OF DESIGN MOCP MCA	REMARKS		
ACC-1	50	42	101	20.0	98°F	480 3 60	175 128	1,2,3,4,5		
GENERAL NOTES: 1. MAXIMUM FOULING FACTOR FOR THE EVAPORATOR IS 0.0001. 2. MAINTAIN MINIMUM CLEARANCES REQUIRED BY CHILLER MANUFACTURER FOR PROPER AIRFLOW TO FANS AND UNIT. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON EQUIPMENT FOR SERVICE, MAINTENANCE AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCES AS REQUIRED BY NEC. 3. CHILLER SHALL MEET OR EXCEED BOTH MINIMUM AHRI STANDARDIZED FULL-LOAD AND PART LOAD EFFICIENCIES INDICATED BY NEC. REMARKS: 1. PROVIDE WITH LOW AMBIENT HEAD PRESSURE CONTROL. 2. PROVIDE WITH INTEGRAL MAIN ELECTRICAL DISCONNECT SWITCH. 3. PROVIDE WITH INSULATION ON ALL SUCTION LINES. 4. PROVIDE WITH POLYMER CONDENSER FANS AND COMPRESSOR BLANKETS. 5. PROVIDE WITH A MINIMUM FULL LOAD EFFICIENCY OF 10.03 EER AND A MINIMUM IPLV OF 16.21.										

GRILLE								
MARK	SERVICE	TYPE	DAMPER	CONSTRUCTION MATERIAL	FINISH COLOR	MANUFACTURER	MODEL NUMBER	DESCRIPTION
A	SUPPLY AIR	DIFFUSER	-	STEEL	WHITE	TITUS	OMNI	EXPPOSED T-BAR CEILING FRAME STYLE WITH 24"x24" OR 12"x12" FACE.
B	RETURN AIR	GRILLE	-	STEEL	WHITE	TITUS	PAR	EXPPOSED T-BAR CEILING FRAME STYLE WITH A 24"x24" FACE. PERFORATED.
C	EXHAUST AIR	GRILLE	-	STEEL	WHITE	TITUS	PAR	EXPPOSED T-BAR CEILING FRAME STYLE WITH A 24"x24" OR 12"x12" FACE. PERFORATED FACE.
D	SUPPLY AIR	DIFFUSER	-	STEEL	WHITE	TITUS	300RL	DOUBLE DEFLECTION SIDEWALL GRILLE WITH HORIZONTAL FRONT BARS. SURFACE MOUNTED
E	RETURN AIR	GRILLE	-	STEEL	WHITE	TITUS	350RL	DOUBLE DEFLECTION SIDEWALL GRILLE WITH HORIZONTAL FRONT BARS. SURFACE MOUNTED
G	EXHAUST AIR	GRILLE	-	STEEL	WHITE	TITUS	350RL	DOUBLE DEFLECTION SIDEWALL GRILLE WITH HORIZONTAL FRONT BARS. SURFACE MOUNTED
GENERAL NOTES: 1. DAMPERS NOTED AS U.L. SHALL BE A "U.L." CLASSIFIED CEILING RADIATION DAMPER WITH THERMAL BLANKET. 2. COORDINATE FINAL AIR DEVICE LOCATION AND FINISH COLOR WITH ARCHITECT.								
REMARKS: 1. N/A								

GAS FIRED INFARED HEATER										
MARK	BTUH HIGH LOW	FLUE DIA. (IN.)	CURRENT CHARAC. V PH F	MANUFACTURER	MODEL NUMBER	TYPE	REMARKS			
B-1	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-2	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-3	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-4	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-5	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-6	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-7	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
B-8	60000.0 50000.0 Btu/h	4	120 1 60	REZNOR	VPL-60-RL50	GAS FIRED TUBE HEATER	1,2,3,4			
REMARKS: 1. PROVIDE MANUFACTURER'S RECOMMENDED MOUNTING HEIGHTS AND CLEARANCES 2. TWO SIDED REFLECTOR SHALL BE INSTALLED TO PROJECT HEAT AWAY FROM EXTERIOR WALLS. 3. GAS FIRE TUBULAR HEATER SHALL BE STAINLESS STEEL CONSTRUCTION. 4. PROVIDE ROOF VENTING CAP AND COMBUSTION AIR CAP TYPE, SIZE, LOCATION AND CLEARANCE BY MANUFACTURERS RECOMMENDATIONS.										

DUCTLESS MINI-SPLIT - INDOOR UNIT										
MARK	SUPPLY AIR CFM	OUTSIDE AIR CFM	EXT. STATIC PRESSURE (IN. W.C.)	HORSE POWER (WATTS)	CURRENT CHARAC. V P F	AIR TEMPERATURE (°F) ENTERING DRY BULB ENTERING WET BULB	MIN. TOTAL CAPACITY (BTUH)	MIN. SENS. CAPACITY (BTUH)	MINIMUM EER/ SEER	REMARKS
DMS-1	370	0	0.10	40.0	208 1 60	75.0	17,100	13,680	-15.2	1,2,3,4,5,6
GENERAL NOTES: 1. EXTERNAL STATIC PRESSURE INCLUDES LOSSES DUE TO DUCTWORK, AIR DEVICES, DAMPERS, AND DUCT MOUNTED HOT WATER COILS WHERE APPLICABLE. DIRTY FILTER AND UNIT CASING MUST BE ADDED TO EXTERNAL STATIC PRESSURE TO OBTAIN TOTAL PRESSURE LOSS. INCREASE HORSEPOWER AS REQUIRED TO MEET YOUR TOTAL PRESSURE LOSS. COORDINATE WITH ELECTRICIAN. 2. MAINTAIN MINIMUM CLEARANCE FOR COIL PULL AS RECOMMENDED BY UNIT MANUFACTURER. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC. REMARKS: 1. UNIT TO BE INSTALLED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS. 2. CONTROLLED BY PROGRAMMABLE WIRED THERMOSTAT. 3. REFRIGERANT LINES TO BE SIZED PER MANUFACTURER'S REQUIREMENTS. 4. INDOOR UNIT IS POWERED FROM OUTDOOR UNIT. 5. PROVIDE INTEGRAL MINI SPLIT CONDENSATE PUMP KIT ASP-MA-UNI MINI AQUA BY ASPEN PUMPS OR EQUAL. CONDENSATE PUMP SHALL BE INSTALLED INSIDE HIGH WALL UNIT. REFER TO MANUFACTURER INSTALLATION INSTRUCTIONS. 6. PROVIDE CONDENSATE OVERFLOW SWITCH TO DEACTIVATE UNIT IN THE EVENT OF AN OVERFLOW CONDITION.										

BOILER - FORCED AIR (OUTDOOR)										
MARK	TYPE	MINIMUM GAS INPUT (MBH)	MINIMUM HEAT OUTPUT (MBH)	PRESSURE DROP (FT H2O)	GPM	FLUE SIZE	ELECTRICAL BLOWER HORSEPOWER CURRENT V P F			MANUFACTURER MODEL NUMBER REMARKS
B-1	NON-CONDENSING	500.0	425.0	10.0	43.0	6	0.50	120	1 60	LOCHINVAR PBN0502 1,2,3
GENERAL NOTES: 1. PROVIDE 8 OUNCE GAS PRESSURE TO BOILER. 2. MAINTAIN MINIMUM CLEARANCE AROUND A BOILER OF 24 INCHES PER TEXAS BOILER LAW. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS FOR SERVICE, MAINTENANCE AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCES AS REQUIRED BY NEC. REMARKS: 1. PROVIDE WITH CIRCULATING PUMP. SIZED BY BOILER MANUFACTURER TO ENSURE CONSTANT FLOW THROUGH BOILER. PUMP TO BE SHIPPED LOOSE. POWER BY ELECTRICAL CONTRACTOR BUT CONTROLLED BY BOILER CONTRACTOR TO WIRE FROM BOILER PUMP CONTROL CIRCUIT TO PUMP STARTER RELAY. 2. PROVIDE SEALED COMBUSTION BOILER.										

VEHICLE EXHAUST SYSTEM SCHEDULE	
VT-1	ASCENT SYSTEM VACUUM HOLSTER MODEL # VH-620ES. INCLUDES 6' x 20' HT HOSE, A6STA TAILPIPE ADAPTER WITH SILICON BOOT, DIRECT CLAMPING DEVICE & SS DAMPER. BRACKET SUSPENSION KIT A6BHS HOLSTERS SUPPLIED IN BLACK UNLESS CALLED OUT OTHERWISE.
EF-3 EF-4	(REFER TO FAN SCHEDULE)
CP-1 CP-2	CONTROLLED BY REMOTE START CONTROL PANEL (120/360 SUPPLY REQUIRED) AND WIRELESS TRANSMITTER.
GENERAL NOTES: 1. DUCT SIDE AT 2,500 FEET PER MINUTE AND MINIMUM 26 GAUGE SPIRAL DUCT TO BE USED. 2. LOCATION OF RAIL, DROP AND FANS CONFIRM WITH OWNER.	

UNIT HEATER - ELECTRIC										
MARK	MINIMUM CAPACITY (BTUH)	KW	NUMBER OF STAGES	CURRENT CHAR. V P F	CFM	MANUFACTURER	MODEL	REMARKS		
EUH-1	10,236	3	2	208 1 60	430	REZNOR	EUH	1,2		
EUH-2	10,236	3	2	208 1 60	430	REZNOR	EUH	1,2		
EUH-3	10,236	3	2	208 1 60	430	REZNOR	EUH	1,2		
REMARKS: 1. PROVIDE WITH PENDANT MOUNTED THERMOSTAT. 2. PROVIDE WITH DISCONNECT SWITCH.										

NO.	ISSUE	DATE
	Schematic Design	03/06/2024
	Design Development	05/20/2024
	Owner's Final Review	08/02/2024
	Bids and Construction	08/21/2024
1	ADDENDUM #2	09/23/2024
2	ADDENDUM #3	10/23/2021

SHEET NUMBER:

M500

SHEET NAME:

MECHANICAL SCHEDULES

SCALE:

PROJECT NUMBER:

23042



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