WDD ARCHITECTS
5050 NORTHSHORE LN
NORTH LITTLE ROCK, AR 72118

WDD ARCHITECTS

NEW MAINTENANCE SHOP

CRAIGHEAD ELECTRIC COOPERATIVE CORPORATION

JONESBORO, ARKANSAS

WDD PROJECT NO. 24-096

ISSUE SET

FEBRUARY 14, 2025

WITTENBERG, DELONY & DAVIDSON, INC.
5050 NORTHSHORE LN, NORTH LITTLE ROCK, ARKANSAS 72118
(501) 376-6681

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BATSON INC. | ENGINEERING SOLUTIONS
1300 BROOKWOOD DR, LITTLE ROCK, ARKANSAS 72202

Structural Engineers
PHILLIP LEWIS ENGINEERING, INC.
23620 I-30, BRYANT, ARKANSAS 72022

Civil Engineers
ASSOCIATED ENGINEERING AND TESTING, LLC
103 SOUTH CHURCH STREET, JONESBORO, ARKANSAS 72403

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FOR
MAINTENANCE SHOP ADDITION
CRAIGHEAD ELECTRIC COOPERATIVE
JONESBORO, ARKANSAS

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POST-BID ADDENDUM NO. 1 - Issued 04-03-2025
to the Project Manual and Drawings for

MAINTENANCE SHOP ADDITION
CRAIGHEAD ELECTRIC COOPERATIVE
JONESBORO, ARKANSAS
WDD JOB NO. 24-096

WITTENBERG, DELONY & DAVIDSON, INC.
5050 NORTHSHORE LANE
NORTH LITTLE ROCK, ARKANSAS 72118
(501)376-6681

This addendum forms a part of the contract documents and modifies or interprets the Project Manual and/or Drawings as noted herein.

GENERAL INFORMATION:

1. Refer to Narrative (8 Sheets) titled Craighead Electric, Maintenance Shop Addition, Project No. 24-096, Post Bid Addendum #1, dated 04-03-2025, which is attached to this addendum and is made a part of the Bid Documents.

REFER TO THE PROJECT MANUAL:

Section 00 11 16:

1. See Part 1.01 where the contractor has the option to submit electronic submission via email, but signed paper document forms shall be delivered to architect by stated date, prior to issuance of certified Bid Tabulation form.

Section 00 41 13:

1. Contractor shall fill in all requisite blank lines as if this were a new Bid Form and not assume that any previously submitted bid information will be carried forward. This includes number of construction days, addenda (1 & 2), Unit Prices (1 & 2), and List of Subcontractors. In addition to revised Base Bid price, Contractor may fill in revised Unit Prices (if any), and different subcontractors not previously listed.

Section 06 61 16:

1. DELETE Solid Surfacing Fabrications Section in its entirety.

Section 07 41 13:

1. DELETE Metal Roof Panels Section in its entirety. Refer to Section 13 34 19 - Metal Building Systems.

Section 07 42 13:

1. DELETE Metal Wall Panels Section in its entirety. Refer to Section 13 34 19 - Metal Building Systems.

Section 09 31 00:

1. DELETE Thin-Set Tile Section in its entirety.

Section 09 65 19:

1. DELETE Resilient Tile Flooring Section in its entirety.

Section 09 67 00:

1. DELETE Fluid-Applied Flooring Section in its entirety.

Section 10 51 29:

1. DELETE Phenolic Lockers Section in its entirety.

Section 26 32 13:

1. DELETE Diesel Engine-Drive Generator Sets Section in its entirety.

ADDENDUM SPECIFICATION SECTIONS:

Section 00 11 16 - Invitation To Bid, Section 00 41 13 - Bid Form-Stipulated Sum (Single Prime Contract), Section 13 34 19 - Metal Building Systems, and section 23 09 93 - Controls Sequences dated 04-03-2025 are attached to this addendum and are made a part of the Bid Documents.

REVISED DRAWINGS:

Sheets T110, T120, A110, A120, A150, A201, A310, A320, A321, A322, A330, A410, A420, A460, A610, A611, A620, S100, S101, S102, S201, S103, M001, M101, M102, M201, M301, M401, M501, P101, P201, P401, E001, E201, E301, E302, E401, E501, E601, and F101 of original issue date 02-14-2024 and revised 04-03-2025 are attached to this addendum and are made a part of the Bid Documents.

ISSUE DRAWINGS:

Sheet M402 of original issue date 02-14-2024 is attached to this addendum and is made a part of the Bid Documents.

END OF POST-BID ADDENDUM NO. 1

Craighead Electric	04/03/25
Maintenance Shop Addition	Post Bid ADD#1
PROJECT NO. 24-096	

The scope of this Addendum is to revise the originally issued construction documents for the Craighead Electric Maintenance Shop Addition dated 02/14/25, and all the subsequent contract modifications to reflect the following:

Summary of Changes

- VE updates
- Revise exterior finish update
- Revise flooring
- MEP updates

SPECIFICATIONS

Section 23 09 93 – CONTROL SEQUENCES

1. Revised specification section.

Section 26 32 13 – DIESEL ENGINE-DRIVEN GENERATOR SETS

1. Delete specification section in its entirety from project. Generator will be owner-furnished, owner-installed.

Section 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. Refer to Paragraph 2.01(C). Add Type GD General-Duty fusible disconnects as acceptable equipment.
2. Refer to Paragraph 2.02(D). Add Type GD General-Duty non-fusible disconnects as acceptable equipment.

GENERAL

SHEET T110 – SHEET INDEX AND GENERAL INFORMATION

SHEET INDEX

1. Added sheet M402

SHEET T120 – LIFE SAFETY PLAN AND CODE INFORMATION

CODE NOTES

1. Revised note
2. Revised “OCCUPANCY CLASSIFICATION” information
3. Revised “ACTUAL AREA” and “SEPARATION” information

LIFE SAFETY SYMBOL LEGEND

1. Add “1 HR FIRE WALL”, removed “2 HR FIRE WALL”

Detail 1 - LIFE SAFETY PLAN

1. Revised walls at Breakroom
2. Sprinkler information added

Detail 2 - LIFE SAFETY PLAN - MEZZANINE

1. Sprinkler information added
2. Show fire wall

ARCHITECTURAL

SHEET A110 – DIMENSIONED FLOOR PLAN

Detail 1 - DIMENSIONED FLOOR PLAN

1. Add note
2. Removed Dimension

SHEET A120 – NOTED FLOOR PLAN
Detail 1 - NOTED FLOOR PLAN
1. Revised wall, remove cased opening
2. Revised wall and removed section marker

Detail 5 - COLUMN WRAP
1. Revised note

SHEET A150 – ROOF PLAN
KEYNOTE LEGEND
1. Revised KN 7.03

Detail 3 - TYPICAL EXTERIOR ROOF ASSEMBLY - RIDGE DETAIL
1. Detail revised

SHEET A201 – EXTERIOR ELEVATIONS
KEYNOTE LEGEND
1. Revised KN 7.03

Detail 1 - WEST ELEVATION
1. Add Keynote
2. Add Keynote

Detail 2 - EAST ELEVATION
1. Add Keynote
2. Add Keynote

Detail 4 - SOUTH ELEVATION
1. Add Keynote

SHEET A310 – BUILDING SECTIONS
Detail 3 – BUILDING SECTION
1. Revised Keynote

Detail 4 – BUILDING SECTION
1. Revised Keynote

Detail 5 – BUILDING SECTION
1. Revised Keynote

SHEET A320 – WALL SECTIONS
Detail 1 – BUILDING SECTION
1. Revised note
2. Revised note

Detail 2 – BUILDING SECTION
1. Revised note
2. Revised note

Detail 3 – BUILDING SECTION
1. Detail revised

Detail 4 – BUILDING SECTION
1. Detail revised

SHEET A321 – WALL SECTIONS

Detail 1 – BUILDING SECTION
1. Revised note
2. Revised note

Detail 2 – BUILDING SECTION
1. Revised note
2. Revised note

Detail 3 – BUILDING SECTION
1. Revised note
2. Revised note

Detail 4 – BUILDING SECTION
1. Revised note
2. Revised note
3. Note added

Detail 5 – BUILDING SECTION
1. Add note
2. Revised note

SHEET A322 – EXTERIOR DETAILS

Detail 1 - FOUNDATION DETAIL
1. Revised note

Detail 2 - FOUNDATION DETAIL
1. Detail removed

Detail 3 - FOUNDATION DETAIL
1. Revised note

Detail 4 - METAL CANOPY CONNECTION
1. Revised note

Detail 5 - TYPICAL EXTERIOR WALL ASSEMBLY
1. Revised note
2. Revised note
3. Revised note
4. Removed note

Detail 6 – CORNER DETAIL
1. Revised note
2. Revised note

Detail 8 - CONNECTION DETAIL
1. Revised note
2. Add notes
3. Removed CMU
4. Add notes

Detail 11 - CMU TO METAL PANEL TRANSITION
1. Revised note
2. Removed note
3. Add plywood Sheathing

SHEET A330 – PARTITION TYPES, DETAILS AND INTERIOR DETAILS

PARTITION LEGEND

1. Add note
2. Add wall type

SHEET A410 – ENLARGED PLANS

Detail 1 - ENLARGED OFFICE PLAN

1. Revised door
2. Removed height and revised wall tag
3. Removed height and revised wall tag
4. Removed height and revised wall tag
5. Removed height and revised wall tag
6. Removed height and revised wall tag
7. Revised wall tag
8. Revised wall tag
9. Revised wall tag
10. Revised door

SHEET A420 – ENLARGED TOILET PLANS AND ELEVATIONS

1. Entire sheet revised

SHEET A460 – INTERIOR ELEVATIONS AND MILLWORK DETAILS

Detail 1 - BREAKROOM ELEVATION

1. Revised finish
2. Revised countertop

Detail 3 - PRINT AREA ELEVATION

1. Revised countertop

Detail 16 - MILLWORK DETAIL - COUNTERTOP, NOSING & EDGE PROFILES

1. Removed “SOLID SURFACE TOP & NOSING DETAIL”

SHEET A610 – FINISH SCHEDULE, PLAN, AND DETAILS

PRODUCT LEGEND

1. Revised SN #6
2. Revised SN #9

PRODUCT LEGEND

1. EP-1, SS-1, WT-1, WT-2
2. Add GYP-1, SC-1, PL-3, CG-1, EP-1,

Detail 1 - ENLARGED OFFICE PLAN

1. Removed LVT-1 and LVT-2

Detail 1 - FLOOR PLAN

1. Revised flooring
2. Revised flooring
3. Revised flooring
4. Revised flooring
5. Revised flooring
6. Revised flooring
7. Revised flooring
8. Revised flooring
9. Revised flooring

SHEET A611 – FURNITURE, FIXTURES, AND EQUIPMENT PLAN AND SCHEDULES
EQUIPMENT SCHEDULE
1. Revised responsibility information

SHEET A620 – WINDOW LEGEND, DOOR SCHEDULE & DETAILS
DOOR SCHEDULE
1. Revised door 101A, 104B, 105A, 106A, 108A ,114A, 114B, 116A
2. Removed 105C, 116C

STRUCTURAL

SHEET S101 – FOUNDATION PLAN
Detail 1 – FOUNDATION PLAN
1. Removed CMU walls adjacent to existing structure, updating section callouts and dimensions as necessary

SHEET S102 – FOUNDATION DETAILS
Detail 1 – SECTION “K”
1. Clouded strike-out/Exclusion of section “k” no longer to be used

MECHANICAL

SHEET M001 – MECHANICAL NOTES, LEGEND, & INDEX
1. Revised Mechanical Drawing Index.

SHEET M101 – HVAC FLOOR PLAN
Detail 1 – HVAC FLOOR PLAN
1. Deleted outdoor unit HRU-D3.
2. Revised location of outdoor units HRU-1, HRU-D1 and DHP-1.
3. Revised exhaust air ductwork sizes, air devices and airflows serving Shop Bays 100 from EF-4.
4. Added keyed note #20.

SHEET M102 – MEZZANINE MECHANICAL PLANS
Detail 1 – MEZZANINE HVAC PLAN
1. Deleted exhaust fan EF-5.
2. Revised exhaust air ductwork sizes serving Shop Bays 100.
3. Deleted smoke detector serving deleted DOAS-3.
4. Revised outside supply air ductwork, air devices and airflows serving Shop Bays 100 from DOAS-2.
5. Revised outside air intake louvers L-2, L-6 & L-7.
6. Revised exhaust air louver L-3.

Detail 2 – MEZZANINE MECHANICAL PIPING PLAN
1. Deleted Dedicated Outdoor Air Unit DOAS-3 all associated refrigerant piping and condensate drain piping.
2. Deleted branch selectors BS-11 thru BS-15.
3. Revised keyed note #12.
4. Added keyed note #17.

SHEET M201 – MECHANICAL PIPING FLOOR PLAN
Detail 1 – MECHANICAL PIPING FLOOR PLAN
1. Deleted outdoor unit HRU-D3 and all associated refrigerant piping.
2. Revised location of outdoor units HRU-1, HRU-D1 and DHP-1.
3. Deleted condensate drain piping from deleted DOAS-3 above Office 119.
4. Revised refrigerant piping and condensate drain piping in Elec Room 105.

5. Revised keyed note #1.
6. Added keyed note #15.

SHEET M301 – MECHANICAL SECTIONS
1. Revised Office Area Ductwork Section.
2. Revised Shop Area Ductwork Section.

SHEET M401 – MECHANICAL DETAILS
Detail 20 – DOAS-2
1. Revised name for detail 20/M401.

SHEET M402 – MECHANICAL DETAILS

1. Added sheet M402 depicting Variable Refrigerant Volume (VRV) piping.

SHEET M501 – MECHANICAL SCHEDULES
1. Revised Variable Refrigerant Volume – Air-Cooled Condensing Unit Schedule.
2. Revised Dedicated Outdoor Air Unit Schedule.
3. Revised Variable Refrigerant Volume – Branch Selector Schedule.
4. Revised Air Device Schedule.
5. Revised Exhaust Fan Schedule.
6. Revised Louver Schedule.

PLUMBING

SHEET P101 – SANITARY SEWER PLAN
Detail 1 – SANITARY SEWER PLAN
1. Sheet being issued to reflect architectural changes.

SHEET P201 – DOMESTIC WATER PLAN
Detail 1 – DOMESTIC WATER PLAN
1. Sheet being issued to reflect architectural changes.

SHEET P401 – PLUMBING SCHEDULES AND RISERS
PLUMBING FIXTURE SCHEDULE
1. Changed faucet specification for lavatories P-2 and P-2A.
2. Changed ADA shower specification for P-10.

ELECTRICAL

SHEET E001 – ELECTRICAL NOTES, LEGEND, & INDEX
LIGHTING FIXTURE SCHEDULE
1. Revised model number of the following Lighting Fixture types: A, B, B1, J, J1, J2, J3, X, AA, BB, BBE.
2. Deleted Lighting Fixture types BE & B2 from project.

SHEET E201 – ELECTRICAL LIGHTING PLAN
Detail 1 – ELECTRICAL LIGHTING PLAN
1. Updated floor plan to reflect architectural plan changes.
2. Removed and replaced recessed linear fixtures with 2x2 lay-in fixtures in the following areas: Construction Office, Private Offices, Break Room, Corridor, Entry/Lockers.

SHEET E301 – ELECTRICAL POWER & SYSTEMS PLAN
Detail 1 – ELECTRICAL POWER & SYSTEMS PLAN
1. Updated floor plan to reflect architectural plan changes.

2. Deleted generator from contractor's scope of work. Generator will be owner-furnished, owner-installed.
3. Deleted Generator EPO.
4. Deleted Generator Annunciator Panel.
5. Deleted Generator Battery Charger and Block Heater circuits. Modified keyed notes to provide conduit stub-ups only.
6. Deleted controls wiring between Automatic Transfer Switch and Generator. Modified keyed note to provide and install conduit between generator pad and transfer switch only.
7. Deleted keyed note for relocation of existing fiber optic conduit stub-up.
8. Revised circuits to reflect panel name change from "MP2" to "MP1" for the following circuits: Air Dryer, Air Compressors 1 & 2, Overhead Crane, 4-Post Lift, 2-Post Lift.
9. Revised keyed note to reflect panel name change from "MP2" to "MP1" for grinder station.

SHEET E302 – ELECTRICAL MEZZANINE AND ENLARGED PLANS

Detail 1 – ENLARGED ELECTRICAL ROOM

1. Deleted Panel "MP1".
2. Renamed Panel "MP2" to "MP1".
3. Moved location of Fire Alarm Control Panel.
4. Moved location of Panel "EQ1".

Detail 5 – MEZZANINE POWER PLAN

1. Deleted duct smoke detector for DOAS-3.

Detail 6 – MEZZANINE HVAC EQUIPMENT POWER PLAN

1. Deleted circuiting for DOAS-3.
2. Showed location of BS-10.
3. Deleted circuiting for BS-11 thru BS-15.
4. Modified keyed notes to clarify mechanical circuiting and interlocking of equipment.

SHEET E401 – HVAC EQUIPMENT POWER PLAN

Detail 1 – HVAC EQUIPMENT POWER PLAN

1. Updated floor plan to reflect architectural plan changes.
2. Deleted circuiting for HRU-D3.
3. Relocated circuiting for HRU-D1, HRU-1, and DHP-1.
4. Modified keyed notes to delete references to EF-5.
5. Modified keyed note to reflect "MP2" to "MP1" name change.

HVAC EQUIPMENT CIRCUIT SCHEDULE

1. Revised circuit number for DOAS-2.
2. Revised circuit numbers for HRU-D2.
3. Deleted circuit for DOAS-3.
4. Deleted circuits for HRU-D3.
5. Deleted circuit for EF-5.
6. Deleted circuits for BS-11 thru BS-15.
7. Revised circuits to reflect panel "MP2" to "MP1" name change.

SHEET E501 – ELECTRICAL ONE-LINE DIAGRAM

Detail 1 – ELECTRICAL ONE-LINE DIAGRAM

1. Deleted "MP1" panel feeder and breaker from "MDP".
2. Renamed panel "MP2" to "MP1".
3. Added note that generator is now Owner-Furnished, Owner-Installed.
4. Moved DOAS-2 & HRU-D2 circuits from original "MP1" to "MDP".
5. Revised generator feeder tag to indicate conduit stub-ups only.
6. Added feeder tags #12, #13 & #14.

SHEET E501 – ELECTRICAL PANEL SCHEDULES

PANEL SCHEDULE "MDP"

1. Deleted breaker for "MP1".
2. Added DOAS-2, HRU-D2 circuits #1, #2, & #3 to "MDP" from "MP1".

PANEL SCHEDULE "EDP"

1. Revised circuit #5 to reflect panel name change from "MP2" to "MP1".

PANEL SCHEDULE "EQ1"

1. Deleted generator block heater and battery charger circuits.

PANEL SCHEDULE "MP1"

1. Deleted panelboard from project.

PANEL SCHEDULE "MP2"

1. Renamed panel to "MP1".
2. Deleted circuits for BS-11 thru BS-15.
3. Deleted circuit for EF-5.

FIRE PROTECTION

SHEET F101 – FIRE PROTECTION FLOOR PLAN

Detail 1 – FIRE PROTECTION FLOOR PLAN

1. Revised outline of dry pipe sprinkler system to include Wash Bay 125.
2. Revised keyed note #8.
3. Revised keyed note #10.

End of Post Bid ADD #1

1.01 Sealed bids for construction of a New Maintenance Shop Addition will be received until 2:00 PM, Local Time on Thursday, April 17, 2025, at the office of the architect, WDD Architects, 5050 Northshore Lane, North Little Rock, AR 72118. Electronic submissions will be allowed.

A. Bids will be received and reviewed by the architect and the owner privately. They will not be opened publicly and read aloud.

B. Email to Gordon Duckworth by 2:00 PM, duck@wddarchitects.com

1. If electronic submission made, please deliver signed paper forms in a sealed envelope to the attention of Gordon Duckworth, to be received no later than end of business, Tuesday, April 22, 2025, or (3) three business days after the bid date.

1.02 There will be no pre-bid conference but contractors may schedule a site visit by contacting Jason Gazaway at Gazaway & White Commercial Real Estate, (870) 236-1115. **The Owner reserves the right to schedule any meetings.**

1.03 The work includes Site Preparation and Improvements, General Construction, Mechanical Work, Plumbing Work and Electrical Work, all to be let under one prime contract.

1.04 **Bid Security:** A cashier's check or acceptable bidder's bond payable to the Owner in an amount not less than 5% of the base bid submitted must accompany each bid as a guarantee that, if awarded the contract, the bidder will promptly enter into a contract and execute such bonds as may be required. If a Bid Bond is provided, the Bond must be signed by an authorized agent of the Bonding Company and the agent's power of attorney must be submitted with the Bid Bond.

1.05 Copies of drawings, specification and other proposed contract documents are on file and are open to inspection at the following places.

Wittenberg, Delony & Davidson, Inc.
Southern Reprographics Plan Room

1.06 Prime Bidders may obtain up to one (1) full-sized set of Bidding Documents from Southern Reprographics, Inc., 901 West 7th, Little Rock, Arkansas 72201, Tel: 501-372-4011, upon deposit by means of a credit/debit card, on account, or check in the amount of **$100** per set, payable to Wittenberg, Delony & Davidson, Inc. Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return paper Bidding Documents in good condition within ten (10) days after receipt of Bids. A Bidder receiving a Contract award may retain paper Bidding Documents, and the Bidder’s deposit will be refunded. Additional sets or partial sets of Bidding Documents, including addenda, may be obtained for the actual cost of printing, shipping and handling, and will be non-refundable. Prime Bidders may also obtain Bidding Documents in electronic format through Southern Reprographics at www.sriplanroom.com for a non-refundable fee as pre-determined by level of access.

1.07 Bidders, sub-bidders, material suppliers and other interested parties are encouraged to obtain complete sets of Bid Documents from the Architect. Complete sets of Bid Documents should always be used in preparing bids. Neither the Owner nor Architect assumes responsibility for errors in bidding or misinterpretations of Bid Documents resulting from the use of incomplete sets of Bid Documents. The documents obtained through the Architect are considered the official version and take precedence if any discrepancies occur. The use of incomplete or inaccurate Bid Documents does not relieve the bidder of the obligation to perform all work related to his bid as detailed in a complete set of Bid Documents.

1.10 All bidders shall conform to the requirements of Arkansas Code Annotated 17-25-101, Arkansas State Licensing Law for Contractors.

1.11 The Owner reserves the right to waive any formalities in, or to reject any or all bids.

1.12 No bidder may withdraw his bid within 60 days after the date of the opening thereof.

1.13 Each bid must be submitted in a sealed envelope bearing, on the outside, the name of the bidder, their Arkansas Contractor License number, their address and the project name.

END OF DOCUMENT 00 11 16

CRAIGHEAD ELECTRIC COOPERATIVE CORPORATION
NEW MAINTENANCE SHOP ADDITION
Bid Date: April 17, 2025
Bid Time: 2:00 PM
Jonesboro, Arkansas
WDD Project No.: 24-096

Proposal of _____
(Hereinafter called "Bidder"): (Strike Out Following Inapplicable Items)

1. An _____ Corporation,
   (State)
2. A Partnership, or

3. An Individual doing business as _____

To: **Craighead Electric Cooperative Corporation**

Gentlemen: Bidder, in compliance with bid solicitation for a **New Maintenance Shop Addition, Jonesboro, Arkansas**, having examined plans and specifications with related documents and site of the proposed Work, and being familiar with all conditions surrounding proposed project, including availability of materials and labor, hereby proposes to furnish labor, materials, and supplies, and construct project in accordance with Contract Documents, within time set forth therein, and at prices stated below. Prices are to cover all expenses incurred in performing Work required under Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on date specified in written "Notice to Proceed" and fully complete project within _____ consecutive calendar days.

Bidder acknowledges receipt of the following addenda:

No._____ Date:_____ No._____ Date:_____ No._____ Date:_____

No._____ Date:_____ No._____ Date:_____ No._____ Date:_____

BASE BID: Bidder agrees to perform all Work described in the Project Manual and shown on the

Drawings for the sum of _____

_____Dollars ($_____).

LIST OF UNIT PRICES

The Bidder shall **include in the Base Bid** the following lump sum allowances computed based upon the quantities listed and unit costs indicated. Unit prices include all Contractor cost including labor, material, General Conditions and overhead and profit. Bidder understands that the Owner reserves the right to review and or negotiate Unit Prices that are deemed to be not in accordance with current market value of proposed services.

In the event the actual quantities are greater or less than the given volumes, the unit prices stated will be used to adjust the contract accordingly.

1. **Unit Price No. 1:** Undercut and related replacement fill.

   Unit Price per Cubic Yard: $ _____ per CY

2. **Unit Price No. 2:** For importing, placing and compacting select fill material at undercut areas only. This is in addition to the fill material required to establish grades shown on the drawings which is to be included in the Base Bid.

   Unit Price per Cubic Yard: $ _____ per CY

LIST OF SUBCONTRACTORS

I, the undersigned General Contractor, certify that proposals from the following subcontractors were used in the preparation of my proposal. I agree that if I am the successful bidder, and if following subcontractors are approved, I will not enter into contracts with others for these divisions of the Work without written approval from Architect and Owner.

NAME: LICENSE NO.

MECHANICAL: _____

PLUMBING: _____

ELECTRICAL: _____

ROOFING AND SHEET METAL: _____

PRE-ENGINEERED STRUCTURE: _____

Bidder understands that Owner reserves right to reject any or all bids and to waive any formalities in the bidding. Bidder agrees bid shall be good and may not be withdrawn for period of sixty (60) days after scheduled closing time for receiving bids.

Upon receipt of written notice of acceptance of bid, Bidder will execute formal contract within ten (10) days and deliver Surety Bond or Bonds as required by Document 00 61 13.

Bid security attached in amount of 5% of base bid is to become property of Owner in event above contract and bond are not executed within time set forth above as liquidated damages and additional expenses to Owner.

By:_____ Date:_____

(Typed Name)

_____ Contractor License No._____

(Signature)

_____

(Title)

_____

(Business Address)

_____

(Seal - If bid is by a Corporation)

END OF DOCUMENT 00 41 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish, deliver, and erect pre-engineered metal building components shown on drawings and conforming to these specifications.

B. Furnish building design of manufacturer regularly engaged in fabrication of pre-engineered structures.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Furnish Shop Drawings, for review by Architect showing necessary fabrication details, fittings, fastenings, foundation reactions for all load cases, anchorage and erection details. In addition to provisions of the General Conditions, prepare Shop Drawings by or under the supervision of a registered professional engineer. Do not use reproductions, in any form, of the Contract Drawings for Shop Drawings. Furnish two prints and one sepia reproducible of Shop Drawings submitted to Architect for review. Submit related shop drawings together; partial submittals will not be accepted. Furnish mill certificates on foreign steel proposed for use and not produced within the continental USA. Include with mill certificates certified copies of mill test reports giving names and locations of mills and shops, and chemical analysis and physical properties of steel required for this project.
   2. All drawings and calculations shall bear the stamp of a structural engineer licensed in the state of Arkansas.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Submit roofing manufacturer's inspection report after each of the three (3) required warranty inspections. Report must contain the following:
   1. A detailed description of all non-conforming work.
   2. Manufacturer's recommended method of correction.
   3. Color photographic documentation of non-conforming work.
   4. Color photographic documentation of subsequent accepted work.
   5. Drawings, Diagrams or Detail furnished by the inspector at the jobsite visit.

6. Instructions and conditions for re-inspection and/or issuance of warranty.

1.04 REFERENCE STANDARDS

A. Conform to latest edition of the following standards where applicable to structural design of building:
   1. "Recommended Design Practices Manual", Latest Edition - Metal Building Manufacturer's Association.
   2. "Manual of Steel Construction", Latest Edition - American Institute of Steel Construction
   3. "Cold Formed Steel Design Manual", Latest Edition - American Iron and Steel Institute.
   4. "Aluminum Construction Manual", Latest Edition - The Aluminum Association.
   5. "Code for Welding in Building Construction", Latest Edition - American Welding Society.

1.05 DESIGN LOADS

A. General: Basic design loads include live, wind, and dead loads. Other loads, whether of static, dynamic, or kinetic nature, are considered auxiliary loads.

B. Refer to Pre-Engineered metal building notes on Structural Drawings for Roof Live Load, Roof Dead Load, Superimposed Roof Dead Load, Roof Deflections, Perimeter Wall Deflections, Drift Under Wind Loading and other loading requirements.

C. Certification:
   1. Submit letter from metal building manufacturer certifying that the building proposed will be furnished to meet or exceed all the above design load criteria and that all structural design will be in strict conformance with that prescribed in the MBMA "Design Practices Manual".
   2. After awarding of Contract, submit complete structural analysis prepared by metal building manufacturer to Architect upon request for same.

1.06 GUARANTEES

A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 NBS. units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.

B. Roofing Materials Manufacturer: Provide twenty (20) Year, Weathertightness System Warranty. Warranty is to be equivalent to the Single Source warranty offered by MBCI and is to cover costs up to two (2) times the original invoice price for the roofing system.
   1. Single Source Warranty: Single Source Warranties require a certified installer to be on site at all times.

2. For a period of twenty (20) years from the date of substantial completion, the roofing manufacturer WARRANTS to the Building Owner ("Owner"): that the roofing manufacturer's furnished roof panels, flashing, and related items used to fasten the roof panels and flashing to the roof structure ("Roof System") will not allow intrusion of water from the exterior of the roofing manufacturer's Roof System into the building envelope, when exposed to ordinary weather conditions and ordinary wear and usage. The date of substantial completion is the date that is certified by the Architect, Owner, or Owner's Representative, when the roofing manufacturer's Roofing System is completed and accepted by or on behalf of the Owner.
3. Manufacturer's Field Service:
   a. During installation, provide for two on-site inspections of roof application by qualified technical representative of the manufacturer.
   b. Upon completion of installation, provide final inspection by a technical representative of roofing manufacturer to confirm that roofing system has been installed in accordance with manufacturer's requirements.
4. The roofing manufacturer shall have the **SOLE AND EXCLUSIVE** obligation for all warranty work commencing on the date of substantial completion and under all circumstances terminates on the TWENTY (20) year anniversary of the date certified as Substantial Completion of the roofing manufacturer's Roof System. During the period in which the roofing manufacturer has any warranty obligation, the roofing manufacturer shall take appropriate actions necessary to cause the non-performing portions of the Roof System to perform their proper functions.
5. Roofing Manufacturer's Liability: The total liability of the roofing manufacturer is limited to two (2) times the cost of the roofing manufacturer's Roof System as invoiced to the roofing manufacturer's customer.

C. Roofing Materials Installer: Provide two-year guarantee covering labor, materials, leaks, and defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide pre-engineered structural system by or one of the following manufacturers or approved equal.
   1. Alliance Steel
   2. American Buildings Company
   3. Architectural Integrated Metals
   4. Butler Manufacturing Company
   5. Pinnacle Structures
   6. Varco Pruden
   7. Ludwig Buildings Enterprises, LLC

2.02 PRE-ENGINEERED STRUCTURAL SYSTEM

A. Primary Structural: Frames will consist of welded up plate section columns and roof beams or trusses complete with necessary splice plates for bolted field assembly. All bolts for field assembly of primary framing will be high strength bolts as indicated on erection drawings.

B. Beam and post end-wall frames will consist of end-wall corner posts, end-wall roof beams, and end-wall posts as required by design criteria.

C. Exterior columns will be welded-up "H" sections or cold-formed "C" sections; interior columns will be "H" sections or tube columns.

D. Connection of all major structural members will be made with A 325 high-tensile bolts through pre-punched or pre-drilled holes for exact alignment.

E. **Delegated Design:** Contractor is to assume responsibility for designing specific project components guided by performance criteria set by the design professional. The contractor takes ownership of designing certain elements, like structural components or specialized systems, and ensures compliance with codes and standards. Components to consider include, but are not limited to the following:

1. Metal stud work per Section 09 22 16 - Non-Structural Metal Framing, to include furr-downs and other suspended building elements attached to PEMB components.
2. Metal stud work per Section 05 40 00 - Cold Formed Structural Steel Framing, to include attached wall infill designed to resist exterior wind loads.

2.03 ROOF COVERING, SUPPORTS AND ACCESSORIES

A. Trapezoidal Metal Standing Seam Roof System: Provide MBCI® Double-Lok™ 3-inch high x 24-inch wide structural panel or approved equal with UL Class 90 rating and comply with ASTM E1592 Structural performance of sheet metal roof and siding by uniform static air pressure difference. Roof panels to be 24 gauge (minimum) AZ50 "Galvalume" (ASTM A792) steel substrate in size shown. Profile to be selected by Architect from manufacturer's standard shapes. Configuration to provide specified load carrying capabilities and deflection requirements of this specification. Provide roof panels of "standing-seam interlocking" design secured to purlins with concealed structural fastening system. Provide concealed system allowing roof covering to move independently of any differential thermal movement by the structural framing system. No thermal contact allowed between roof panels and supporting purlin. Furnish standing seams with factory-applied, nonhardening sealant. Continuously lock or crimp seams together by mechanical means during erection. Roof panels with lap-type side (longitudinal) joints and exposed structural fasteners are not acceptable.

B. Fasten roof panels to purlins with concealed steel clip or steel backing device having a protective metallic coating. Through penetration of roofing surface by exposed fasteners is not allowed. Ridge assembly to be manufacturer's standard for system used with concealed attachment.

C. Roof Panel Deflection: Maximum L/180 of its span when supporting applicable vertical live loads.

D. Purlins Configuration, Thickness, and Spacing: Use building manufacturer's standard, provided design criteria, including deflection, is met or exceeded.

E. Roof Jacks and Curbs:
1. Openings 8 inches or smaller may be flashed and sealed to roof panel by jacks provided complete structural support and weathertightness is maintained. Furnish jack material either of metal with protective metallic coating or of plastic alloy with an acrylic film laminated to the exterior surface.
2. Frame openings larger than 8 inches, round or square, with a welded metal base fabricated from factory-enameled, 16 gauge (minimum) galvanized steel. Support base and its appurtenance by the roof purlins and header framing. Provide base minimum projection of 8 inches above the roof weather surface and with the configuration of the flanges matching roof panel. Seal flange-to-panel joint with non-harding sealant and fasten in manner to provide complete support and weathertightness.
3. Provide curbs or jacks as integral component of roofing system designed and supplied by roofing manufacturer.

F. Snow Retention System:
1. Provide "ColorGard" system by LMCurbs, (1-800-284-1412) with the S-5 clamp attachment and "Sno-Clips" spaced as recommended by manufacturer. Provide clamp style to coordinate with roof seam profile being proposed. Provide installation details to Architect for review prior to installation.
2. Finish: Insert pre-finished metal strips into the ColorGard snow bar. Metal strips are to be .050" maximum thickness and 2-1/16" maximum width. Metal strips are to be obtained from metal roof panel manufacturer and are to have the same Kynar 500 finish as the metal roof panels.

G. Finish for roof panels to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect.
1. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils DFT.

2.04 WALL COVERING AND SUPPORTS

A. Wall panels to be 36" wide by 1-1/4" rib height, 26 gauge (minimum) AZ50 "Galvalume" (ASTM A792) steel substrate with exposed fasteners as manufactured by McElroy Metals or approved equal. Color shall be selected from complete line.
1. R-Panel metal panel with 12 inch on center rib spacing, smooth finish.

B. Furnish wall panels with side seams of interlocking type. Lap seams are not acceptable.

C. Fasten wall panels to supports with concealed clips, screws, or bolts to eliminate all exposed fasteners. Exposed screws, bolts, or rivets will not be allowed for securing trim, fascias, gutters, and miscellaneous flashing to either wall or roof panels. All fasteners will be concealed type.

D. Provide top, bottom, and intermediate panel closures, flashing, fascias, gutters, and trim using building manufacturer's standard components compatible with material furnished as wall panels.

E. Girt Configuration and Thickness: Building manufacturer's standard provided design criteria, including deflection and girt spacing, is met.

F. Finish for wall panels to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect.
   1. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils DFT.

2.05 INSULATION SYSTEM

A. Refer to Section 07 21 16 - Blanket Insulation For Metal Buildings.

2.06 STRUCTURAL STEEL PRIMER

A. Give all uncoated structural steel 1 shop coat rust inhibitive (primer) paint which meets or exceeds Federal Specifications TT-P-664, or submit certification that it conforms to a recognized authoritative specification, such as a Federal or Military authority or the Structural Steel Painting Council.

2.07 FLASHING AND TRIM

A. Flashing at the rake and high eave shall not compromise the integrity of the roof system by constricting movement due to thermal expansion and contraction.

B. Panel manufacturer to supply flexible membranes if applicable.

C. Manufacture all trim and flashing from G-90 Galvanized or Galvalume sheet steel to profiles shown.

D. Finish for flashing and trim to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect.
   1. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils DFT.

2.08 LINER PANELS

A. Interior wall paneling to be VP LPR-36, 36 inch wide 28 gauge with 1-1/4" high ribs screwed to framing with self-drilling fasteners. Provide partial-height liners attached to 7'-4" high girt, extending 2" above girt. Attach bottom of panel to base girt or channel as a component of the metal building system or as required. Liner panel to be ASTM A653 Grade 33 steel with a zinc coating. The panel is painted with a white polyester finish on one side and a gray primer coating on the second side. Approved equal product will be considered.

PART 3 - EXECUTION

3.01 GENERAL

A. Deliver and erect the pre-engineered components accessories specified and complying with manufacturer's erection drawings and specifications.

B. Perform assembly and erection by the manufacturer's own crew or by an erector trained and authorized by the manufacturer with the erectors work being inspected and certified by the manufacturer.

3.02 ERECTION

A. Bolt settings and other dimensions shall be held to a tolerance of 1/8-inch±. Use templates or other gaging devices to assure accurate spacing of anchor bolts. Bolt field connections unless otherwise required.

1. Set bases or sill members to obtain uniform bearing. Anchors and anchor bolts for securing members to concrete curb or structural steel sub-frame shall be of black steel, set accurately to templates and of proper size to adequately resist applicable design loads at the base.

B. Wall Panels: Panels shall be applied with configurations shown. Supply panels in single lengths from base to eave with no horizontal joints except at the junction of door units, louver panels, and similar openings. End laps for panels shall be not less than four inches. Walls shall be closed at base and eave, and around doors, frames, louvers, and other similar openings by all related flashing and/or formed closures to assure adequate weathertightness. Flashing or stops will not be required where weather-closed or approved self-flashing panels are used.

C. Roof Panels: Roof panels shall be applied with configurations running in direction of roof slope. Supply panels with no transverse joints except at junctions for roof openings and at roof ridge. Seal end-laps with roof joint sealant. Roof shall be flashed and/or sealed at ridge, eaves, rakes, projections through roof, and elsewhere as necessary to make roof weather tight. Flashing and/or caulking shall be accomplished in a manner that will assure complete weather-tightness.

D. Fasteners for Securing Roof and Wall Panels: Fastening method, size and spacing shall be as specified. Fasteners shall be non-corrosive and of design that will produce a weathertight connection. Clearly show fasteners and fastening method on shop and erection drawings. Exposed fasteners will not be allowed at roof panels.

E. Weatherproofing: Joints between exterior pre-engineered metal building components and other adjacent components and materials shall be designed for and shall receive sealing tapes, gaskets, sealant materials, metal flashing and other methods of sealing as required to provide weathertight joints. Color of sealing materials shall match adjacent metal building components.

END OF SECTION 13 34 19

CONTROL SEQUENCES

1.01 VRV FAN COIL UNITS (FC-01 THROUGH 09, AND HRU-1)

A. Mode of operation:

1. The unit shall be set and locked in auto mode at the thermostat so that both heating and cooling operation can occur as required to maintain the space temperature at setpoint. The system mode shall be either occupied or unoccupied based on a building automation system (BASs) schedule, an operator override command from the BAS, or a temporary occupancy override signal from the space temperature sensor. Commands or overrides from the BAS shall take priority over any local changes made at the space sensor.

B. Occupied mode:

1. The system shall allow for either local control (setpoint input at thermostat) or BAS control (setpoint input at BAS) of the setpoint. The space temperature sensor shall be set for a single occupied space cooling temperature setpoint. The occupied space temperature heating setpoint shall be calculated using an offset differential value of 3°F (adj). The initial occupied space temperature cooling setpoint shall be 72°F (adj). The initial occupied space heating setpoint is automatically set to 69°F based on the 3°F differential value. The occupied space temperature setpoint range shall be limited to within +/-2°F of the unoccupied space temperature setpoints.

2. The unit fan shall be on continuously during occupied operation.

3. On an increase in space temperature above the occupied space temperature setpoint, the unit electronic expansion valve shall modulate as required to maintain the space temperature at the unoccupied space temperature setpoint. Internal PID loop control of the electronic expansion valve should be utilized to minimize over/undershooting of the space temperature from setpoint.

4. Once cooling operation has been engaged, the unit shall not be allowed to enter into heating operation until the space temperature has fallen 1°F below the occupied space temperature setpoint for at least 15 min. If the space temperature falls more than 2°F below the occupied space

temperature setpoint, the 15 min guard timer delay shall be bypassed and the system shall switch from cooling operation to heating operation.

5. On a decrease in space temperature below the occupied space temperature setpoint, the unit electronic expansion valve shall modulate as required to maintain the space temperature at the unoccupied space temperature setpoint. Internal PID loop control of the electronic expansion valve should be utilized to minimize over/undershooting of the space temperature from setpoint. If the space temperature remains below heating setpoint with the vrv operating in full heating, the auxiliary heat shall be commanded on to meet the space temperature setpoint.

6. Once heating operation has been engaged, the unit shall not be allowed to enter into cooling operation until the space temperature has risen 1°F below the occupied space temperature setpoint for at least 15 min. If the space temperature rises more than 2°F above the occupied space temperature setpoint, the 15 min guard timer delay shall be bypassed and the system shall switch from heating operation to cooling operation.

C. Unoccupied mode:
   1. During unoccupied operation, the system shall be subject to the unoccupied mode heating and cooling setpoints. The initial unoccupied heating setpoint shall be 65°F (adj). The initial unoccupied cooling setpoint shall be 80°F (adj).

   2. The space temperature sensor shall be equipped with a temporary occupancy override feature that shall override the system into occupied mode for a period of 2 hours (adj).

D. Emergency power mode:
   1. During emergency power mode, the BAS shall delay the start of HRU-1 by 30 seconds from the initiation of emergency power.

1.02 DOAS (DOAS-1 AND HRU-D1)

A. Airflow control: constant air volume
   1. Supply air fan maintains constant speed to provide setpoint airflow rates for low and high-speed during operation time. Fan speeds will automatically adjust to compensate for changes in air density due to temperature fluctuations and to overcome filter loading.

B. Temperature and humidity control

1. Unit controller sends delta dew point value to Daikin's control box to adjust DX coil and HGRH coil valves to maintain set point for discharge air temperature and humidity control.

1.03 SHOP BAY VENTILATION

A. Occupied mode
   1. During the occupied mode, exhaust fan EF-4, along with DOAS-2 , and HRU-D2 shall be energized. The dampers for associated intake louver L-2 and exhaust louver L-3 shall be opened. The damper for auxiliary intake louvers L-6 and 7 shall be closed.

B. Unoccupied mode
   1. During the unoccupied mode, exhaust fans EF-4, along with DOAS-2, and HRU-D23 shall be de-energize. The dampers for associated intake louver L-2, auxiliary intake louvers L-6 and 7 and exhaust louver L-3 shall be closed.

C. Emergency power mode
   1. During the emergency power mode, exhaust fans EF-4 shall be energized. The dampers for associated intake louver L-2, auxiliary intake louvers L-6 and 7, and exhaust louver L-3 shall be opened. DOAS-2, and HRU-D2 shall be de-energized.

1.04 FAB SHOP 102 WELDING HOOD

A. During welding or plasma cutting operations, exhaust fan EF-3 shall be manually energized using a wall mounted timer switch. The dampers for associated intake louver l-4 and exhaust louver l-5 shall be opened. When timer switch is off, exhaust fan EF-3 shall be de-energized and the dampers for louvers l-4 and 5 shall be closed.

1.05 STORAGE (IT) CLOSET 115

A. Exhaust fan EF-2 shall be thermostatically controlled with a wall mounted thermostat to 80°F(adjustable).

B. Space temperature shall be sensed by the BAS. If space temperature rises to 90°F, the BAS shall alarm.

1.06 RESTROOM EXHAUST FAN (EF-1)

A. OCCUPIED MODE

1. During the occupied mode, exhaust fan EF-1 shall be energized.

B. Unoccupied mode
1. During the unoccupied mode, exhaust fan EF-1 shall be de-energized.

1.07 ELECTRICAL ROOM 105

A. Mini-split heat pump (DSS/DHP-1) shall be thermostatically controlled to 80°F(adjustable).

1.08 FIRE RISER ROOM 106

A. Electric unit heater, EH-1, shall control space temperature to 80°F(adjustable) using a unit integral thermostat.

B. Space temperature shall be sensed by the BAS. If space temperature drops to 40°F, the BAS shall alarm.

1.09 WASH BAY 125

A. Electric unit heaters, EH-2, 3 and 4 shall control space temperature to 50°F(adjustable) using unit integral thermostats.

B. Space temperature shall be sensed by the BAS. If space temperature drops to 40°F, the BAS shall alarm.

END OF SECTION 23 09 93

ADDENDUM NO. 2 - Issued 03-10-2025
to the Project Manual and Drawings for

MAINTENANCE SHOP ADDITION
CRAIGHEAD ELECTRIC COOPERATIVE
JONESBORO, ARKANSAS
WDD JOB NO. 24-096

WITTENBERG, DELONY & DAVIDSON, INC.
5050 NORTHSHORE LANE
NORTH LITTLE ROCK, ARKANSAS 72118
(501)376-6681

This addendum forms a part of the contract documents and modifies or interprets the Project Manual and/or Drawings as noted herein.

GENERAL INFORMATION:

1. WDD Narrative titled Craighead Electric Maintenance Shop Addition ADD#2 and dated 03-10-2025 is attached to this addendum and is made a part of the Bid Documents.

2. WDD Bid Questions/Responses - ADD2 dated 03-10-2025 is attached to this addendum and is made a part of the Bid Documents.

REFER TO THE DRAWINGS:

Sheet A310:

1. Detail 4 shows horizontal line work that appears to be horizontal hand railing but this is actually shelving. Mezzanine railing to be 3 rails as indicated on Sheets A410 and A411.

REVISED DRAWINGS:

Sheets C002, A120, A320, A321, A330, A410, A420, A610, A620, S100, S101, S201, E401, E601, F001, and F101 of original issue date 02-14-2025 and revised 03-10-2025 are attached to this addendum and are made a part of the Bid Documents.

END OF ADDENDUM NO. 2

Craighead Electric	03/10/25
Maintenance Shop Addition	ADD#2
PROJECT NO. 24-096	

The scope of this Addendum is to revise the originally issued construction documents for the Craighead Electric Maintenance Shop Addition dated 02/14/25, and all the subsequent contract modifications to reflect the following:

Summary of Changes

- Response to Bid Questions

ELECTRICAL

Section 26 32 13 – DIESEL ENGINE-DRIVEN GENERATOR SETS

1. Refer to Section 2.01.A. Add Caterpillar as an acceptable generator manufacturer.

CIVIL

SHEET C002 – UTILITY PLAN

Detail 1 – OIL INTERCEPTOR DETAIL AND GREASE TRAP

1. Add second sand trap at north end of building. Revise sewer service north end of building. Add 1" water service to north end of building.
2. Add cutsheets
3. Add cutsheets

ARCHITECTURAL

SHEET A120 – NOTED FLOOR PLAN

Detail 6 – NOT USED

4. Show Detail 6 as "NOT USED"

SHEET A320 – WALL SECTIONS

Detail 4 - WALL SECTION

1. Add annotation

SHEET A321 – WALL SECTIONS

Detail 4 - WALL SECTION

1. Add annotation

Detail 5 – WALL SECTION

1. Section added

SHEET A330 – PARTITION TYPES, DETAILS AND INTERIOR DETAILS

Detail 7 - WALL SECTION

1. Section Added

SHEET A410 – ENLARGED PLANS

Detail 1 - ENLARGED OFFICE PLAN

1. Revise wall tag height
2. Revise dimension
3. Revise wall tag height
4. Revise wall tag height
5. Revise dimension
6. Revise wall tag height
7. Revise wall tag height
8. Revise wall tag height
9. Revise wall tag height
10. Revise wall tag height
11. Revise wall tag height
12. Revise wall tag height
13. Revise wall tag height
14. Revise wall tag height

15. Revise wall tag height, add section
16. Add dimension
17. Add dimension
18. Add dimension string
19. Add wall tag
20. Add dimension
21. Add dimension

SHEET A420 – ENLARGED PLANS
Detail 1 - ENLARGED TOILET PLANS
1. Removed fencing and gate SOW and revise keynotes

SHEET A610 – FINISH SCHEDULE, PLAN, AND DETAILS
SHEET NOTES
1. Add SN 19

Detail 1 – FLOOR PLAN
1. Add boxed note
2. Add paint note
3. Revise flooring at “106 – FIRE RISER”
4. Remove note
5. Revise finish information
6. Revise finish information
7. Revise finish information
8. Revise finish information
9. Add finish information
10. Remove note
11. Remove note
12. Add finish information and boxed note

Detail 5 – MEZZANINE FINISH PLAN
1. Plan added

SHEET A620 – WINDOW LEGEND, DOOR SCHEDULE & DETAILS
DOOR LEGEND
1. Revise flush panel designation.

DOOR SCHEDULE
1. Revise door types for doors: “100E”, “101A”, “108A”, and “202A”.

STRUCTURAL
SHEET S100 – STRUCTURAL NOTES
Detail 1 – STRUCTURAL DESIGN CRITERIA
1. Revised Structural design criteria to reflect consistent usage of IBC 2021 & ASCE 7-16
2. Revised Structural Notes to reflect PEMB roof loads

SHEET S101 – FOUNDATION PLAN
Detail 1 – STRUCTURAL NOTES/SPECIFICATIONS
1. Revised Notes block to reflect changes on S100 (see above)

SHEET S201 – MEZZANINE FRAMING PLAN
Detail 1 – MEZZANINE FRAMING PLAN & PARTIAL HVAC SUPPORT PLAN
1. Addition of approximate hanging HVAC units and respective hanging angle structure locations & renaming of plan view from MEZZANINE FRAMING PLAN to MEZZANINE FRAMING PLAN & PARTIAL HVAC SUPPORT PLAN

2. Revised mezzanine framing plan to include a new section “BD” showing the extension of the mezzanine deck over the break-room wall.
3. Added dimensions for clarity

Detail 2 – SECTION “BD”
1. Addition of new section BD to detail extension of mezzanine decking over wall of break-room below, see section BD for more detail.

ELECTRICAL

SHEET E401 – HVAC EQUIPMENT POWER PLAN

Detail 1 – HVAC EQUIPMENT POWER PLAN
1. Added keyed note for dry-pipe sprinkler system air compressor.

HVAC EQUIPMENT CIRCUIT SCHEDULE
1. Added power for dry-pipe sprinkler system air compressor.

SHEET E601 – ELECTRICAL PANEL SCHEDULES

PANEL SCHEDULE “EQ1”
1. Added dry-pipe sprinkler system air compressor circuit to panel.

FIRE PROTECTION

SHEET F001 – FIRE PROTECTION NOTES, LEGEND, INDEX & MEZZANINE PLAN

FIRE PROTECTION NOTES
1. Revised note 3 to add a dry pipe sprinkler system.

SHEET F101 – FIRE PROTECTION FLOOR PLAN

Detail 1 – FIRE PROTECTION FLOOR PLAN
1. Added keyed note 10 to show protection of Covered Storage/Future Bay 122 and Existing Truck Shed 134 by a dry pipe sprinkler system.

End of ADD #2

BID QUESTIONS

Date of Report Start: 03/10/2025

Contractor bid questions – ADD 2

Questions

1. Both buildings - 26 or 29 gauge liner okay?
    a. Per specifications 07 42 13 – 2.08, Liner to be 28 gauge (minimum).
2. Both buildings - Height of existing? Only dimension I see is to bottom of beam at 26'-5" (rafter beam). Do we know depth of beam and purlins?
    a. Existing truck shed = 15'-8" to eave & 20'-7" to ridge +/-. Should be field verified. Depth of PEMB system by PEMB manufacturer.
3. Both buildings - Concealed fasteners wall panels are specified. Would we be allowed to use our standard PBR which are not concealed fastener?
    a. Use specified product. Concealed fasters are for building exterior. Liner Panel per Metal Panel section 07 42 13 for interior.
4. Wash bay - Appears liner is located above 10' CMU at end walls and full height at sidewalls. Correct?
    a. CMU shown full height on south wall. North wall – CMU goes to 10'. Liner panel should be above CMU on east, north and west walls. East and West walls – Liner panel full height (OHD locations).
5. Maintenance shop - Liner locations correct?
        i. Generally, ref plan on sheet A610 for interior metal panel locations.
    b. LEFT ENDWALL (frame line 8) 15' x full height starting from back sidewall (grid line A).
        i. No Liner panel this wall except Mezzanine level (mezzanine and equipment room)
    c. PARTITION WALL (frame line 13.1? – offset 3' from frame line 13) x full height.
        i. Full height – full length of wall
    d. FRONT SIDEWALL full height x 78'-4" from frame line 9.1 (3'-4" from 10.0) to 13.1 (3' from 13).
        i. Full height – full length of wall from grid '9.1' to '13.'
    e. BACK SIDEWALL full height x 154'-0" from frame line 13.1 to frame line 8.
        i. Full height – full length of wall. Mezzanine above Oil room and electoral room to receive Liner panel. Elec Room and Oil room on level 1 is exposed CMU – no liner panel needed.
    f. BOTH SIDEWALLS above 16'-0" to roof line in last bay which is open 23' x 16'.
        i. No liner panel needed from at room 122 – Covered storage / Future Bay. This is all exterior concealed metal panel finish.
    g. FAB SHOP full height x both sides of walls
        i. Yes – all 4 walls.
    h. RIGHT ENDWALL from 16'-0" above finished floor to roof line. Panels below at the slanted walls at corners will be concealed fastener up to 16'-0" at column wraps.

i. No need to have liner panel at grid 14, which is assumed to be the wall in question. These are all exterior concealed fastener panel finish.

6. The Fire Sprinkler Plans (F001 & F101) call for a Wet Pipe Sprinkler System. What is the intent for the Covered Storage/Future Bay Area? Is this to be Wet (With Heat), A Dry Pipe System or No Fire Sprinklers? If it is a Dry Pipe System, a Dedicated Wiring will have to be installed for the Air Compressor.
    a. The covered storage/future bay area will be served by a dry pipe sprinkler system. This will be reflected in Addendum #2.
7. 4/A320 is the wall section shows 4" block and stopping at finish floor and references 2/A322, 2 /A322 shows 8" CMU and goes below finish floor. Can we confirm if 4" stopping at the finish floor is correct?
    a. Correct, the 4" block will stop at the finished floor.
8. Is all gray CMU to be painted?
    a. All that CMU to be finished per 1/A610.
9. Do I need to have IWR in the 4" smooth cmu in the wash bay?
    a. Yes, the CMU will need Integral Water Repellent at the wash bay CMU.
10. Can Clarifications be submitted with the bid?
    a. Contractors may qualify their bids if acceptable to Jason Gazaway (owner rep).
11. Need info on Lift Station. Civil says refer to plumbing plan and plumbing has nothing about it?
    a. Pump is E/ONE Extreme W-Series Fibereglass Station, Duplex Pumps, 1 hp, 1,725 rpm, 120/240V, 60 Hz, 1 Phase, 1.25" discharge outlet.
12. Need to verify that there are no gas or air lines.
    a. Owner is providing air lines outside of contract. Owner's vendor to design and install.
13. What building code do we need to use? It calls for two different ones on the structural drawings.
    a. IBC 2021 / ASCE 7-16, ill update our notes sheet/notes blocks to stay consistent
14. Can you have them verify the dead load? The spec seems to be written around bar joist.
    a. the dead load for the metal building roof will be
    b. 15 psf dead and collateral load
    c. 20 psf live load
15. 1/A410 - Wall shown to 10' & 12' but ceilings in some areas are at the same height.
    a. Wall heights have been clarified in forthcoming Addendum 2.
16. 1/A410 - Wall between the construction office and breakroom shows to be 12' on the wall tag but on 4/A310 it is shown to the deck? It also appears to show this wall on the south side of the equipment room on 2/A410?
    a. Wall heights have been clarified in forthcoming Addendum 2.
17. What is the partition type between the electrical room and oil room?
    a. Wall heights have been clarified in forthcoming Addendum 2.
18. Can't find detail 5/A120 on the plans?
    a. There is no 6/A120 in the issue set, shown "not used" in forth coming Addendum 2. Detail 5/A120 is on sheet A120 – same sheet as referenced.

19. On Door Schedule/Sheet A620 Door Types F, E, SF and Q are listed although no elevations are shown. Please clarify.
    a. Door types have been clarified in forthcoming Addendum 2
20. Door 100E on Door Schedule/Sheet A620 is listed as E although on Sheet A120/Noted Floor Plan is Overhead Door. Please clarify
    a. Door "100E" is "OH", this will be clarified in forthcoming Addendum 2

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ADDENDUM NO. 1 - Issued 03-06-2025
to the Project Manual and Drawings for

MAINTENANCE SHOP ADDITION
CRAIGHEAD ELECTRIC COOPERATIVE
JONESBORO, ARKANSAS
WDD JOB NO. 24-096

WITTENBERG, DELONY & DAVIDSON, INC.
5050 NORTHSHORE LANE
NORTH LITTLE ROCK, ARKANSAS 72118
(501)376-6681

This addendum forms a part of the contract documents and modifies or interprets the Project Manual and/or Drawings as noted herein.

GENERAL INFORMATION:

1. Summary of Changes Narrative dated 03-06-2025 is attached to this addendum and is made a part of the Bid Documents.

REFER TO THE PROJECT MANUAL:

Section 00 11 16:

1. CHANGE the Bid date to Friday, March 14, 2025 in lieu of Tuesday, March 11, 2025. Time will remain the same.

REFER TO THE DRAWINGS:

Sheet A411:

1. OMIT reference at Detail 3 noting “Steel Bar Grating w/ Checker Nosing”. Treads are concrete filled steel pans per Section Detail BC on Sheet S201.

ADDENDUM SPECIFICATION SECTIONS:

Section 00 11 16 - Invitation to Bid, Section 00 41 13 - Bid Form - Stipulated Sum (Single prime Contract), Section 23 09 93 - Control Sequences, Section 23 74 33 - Dedicated Outdoor Air System, Section 26 32 13 - Diesel Engine-Driven Generator Sets, and Section 26 36 23 - Automatic Transfer Switches dated 03-06-2025 are attached to this addendum and are made a part of the Bid Documents.

REVISED DRAWINGS:

Sheets T120, A100, A101, A110, A120, A130, A201, A310, A320, A321, A322, A410, A620, S100, S101, S102, S103, S201, E001, E201, E301, E302, E401, E501, E601, F001, F101, M101, M102, M201, M301, M401, M501, P101 and P201 of original issue date 02-14-2025 and revised 03-06-2025 are attached to this addendum and are made a part of the Bid Documents.

END OF ADDENDUM NO. 1

Craighead Electric	03/06/25
Maintenance Shop Addition	ADD#1
PROJECT NO. 24-096	

The scope of this Addendum is to revise the originally issued construction documents for the Craighead Electric Maintenance Shop Addition dated 02/14/25, and all the subsequent contract modifications to reflect the following:

Summary of Changes

- Response to Bid Questions

SPECIFICATIONS

Section 23 09 93 – CONTROL SEQUENCES

1. New specification section.

Section 23 74 33 – DEDICATED OUTDOOR AIR SYSTEM

1. This section to replace original section 23 74 33 in its entirety.

Section 26 32 13 – DIESEL ENGINE-DRIVEN GENERATOR SETS

1. This section to replace original section 26 32 13 in its entirety.

Section 26 36 23 – AUTOMATIC TRANSFER SWITCH

1. This section to replace original section 26 32 13 in its entirety.

CIVIL

SHEET C002 – UTILITY PLAN

Detail 1 – OIL INTERCEPTOR DETAIL AND GREASE TRAP

1. Add second sand trap at north end of building. Revise sewer service north end of building. Add 1” water service to north end of building.

ARCHITECTURAL

SHEET A100 – ARCHITECTURAL SITE PLAN

Detail 1 - ARCHITECTURAL SITE PLAN

1. Removed fencing and gate SOW and revise keynotes
2. Removed fencing and gate SOW and revise keynotes
3. Show site concrete saw cutting extents, add note
4. Revise extents of Mechanical Yard

SHEET A101 – ENLARGED ARCHITECTURAL SITE PLAN AND SITE DETAILS

Detail 1 - ENLARGED ARCHITECTURAL SITE PLAN

1. Revise equipment pad and bollards

Detail 5 - CHAIN LINK FENCE TOP & BOTTOM

1. Detail Removed

Detail 6 - CHAINLINK FENCE

1. Detail Removed

Detail 8 - CHAINLINK FENCE POST

1. Detail Removed

Detail 9 - CHAINLINK GATE

1. Detail Removed

SHEET A110 – DIMENSIONED FLOOR PLAN

Detail 1 - DIMENSIONED FLOOR PLAN

1. Show location of pit drains, revise end wall to be CMU, remove 4” CMU wall, add dimensions
2. Revised dimension
3. Added CMU wall, door locations and dimensions

4. Added dimension
5. Added dimension

SHEET A120 – NOTED FLOOR PLAN
KEYNOTE LEGEND
1. Add keynote “22.03”

Detail 1 - NOTED FLOOR PLAN
1. Revise location of pit drain and, add keynote, End wall revised to be CMU
2. Revise location of pit drain, Add keynote
3. Revise end wall to be CMU

Detail 3 - LOCKER ELEVATION
1. Added alternate pricing for Z style double lockers

SHEET A130 – REFLECTED CEILING PLAN
Detail 1 - REFLECTED CEILING PLAN
1. Revised ceiling height at “OFFICE - 117”, “SUPERVISOR OFFICE - 118”, “TOILET – 120”, and “TOILET – 121”

SHEET A201 – EXTERIOR ELEVATIONS
KEYNOTE LEGEND
1. Add KN 04.04

Detail 2 – EAST ELEVATION
1. Show mechanical louver, add Keynote
2. Show mechanical louver, add Keynote
3. Keynote removed
4. Keynote added

SHEET A310 – BUILDING SECTIONS
Detail 1 - BUILDING SECTION
1. Add CMU to end wall
2. Add CMU to end wall

Detail 2 - BUILDING SECTION
1. Add CMU to end wall
2. Add CMU to end wall

SHEET A320 – WALL SECTIONS
Detail 3 - WALL SECTION
1. Entire detail revised

Detail 4 - WALL SECTION
1. Entire detail revised

SHEET A321 – WALL SECTIONS
Detail 4 - WALL SECTION
1. Entire detail added

SHEET A322 – EXTERIOR DETAILS
Detail 2 – FOUNDATION DETAIL
1. Revised CMU and note

SHEET A410 – ENLARGED PLANS

Detail 1 - ENLARGED OFFICE PLAN
1. Add dimensions, revise door locations
2. Add CMU end wall
3. Added dimension

Detail 2 - ENLARGED MEZZANINE PLAN
1. Add CMU end wall

SHEET A620 – WINDOW LEGEND, DOOR SCHEDULE & DETAILS
DOOR SCHEDULE
1. Revise doors 105A and 116A
2. Add doors 105C and 116C

STRUCTURAL
SHEET S101 – FOUNDATION PLAN
Detail 1 – FOUNDATION PLAN
1. Revised Pit drain location in wash bay (between gridlines 1&2)
2. Moved “endwall” column footing locations 2’-8” (plan) east from gridline 13
3. Specified 6” slab thickness in wash bay (between gridlines 1&2)
4. Added 12” CMU partition walls along gridlines 2 & 8 (sections & details on S102)
5. Added exterior Generator slab shown in correct location (sections & details on S102)

SHEET S102 – FOUNDATION DETAILS
Detail 1 – SECTION “E”
1. Revised rebar in interior CMU wall footing

Detail 2 – SECTION “J”
1. Revised Pit Drain Depth to 4’-0” Clear

Detail 3 – SECTION “K”
1. Added new section to detail CMU partition walls

Detail 4 – SECTION “L”
1. Added new section to detail Generator slab & turndown

Detail 5 – Housekeeping Pad Detail
1. Revised Housekeeping pad detail to encompass all housekeeping pads to be built (Dimensions of mezzanine pads included in note above detail)

SHEET S201 – MEZZANINE FRAMING PLAN
Detail 1 – HANGING HVAC STRUCTURE DETAIL
1. Added detail outlining a hanging angle structure to support HVAC equipment over office areas (others to provide hanging HVAC unit weights to PEMB supplier for adequate PEMB member sizing)

MECHANICAL
SHEET M101 – HVAC FLOOR PLAN
Detail 1 – HVAC FLOOR PLAN
1. Revise kitchen hood manufacturer.
2. Revised keyed notes where indicated.

SHEET M102 – MEZZANINE MECHANICAL PLANS
Detail 1 – MEZZANINE HVAC PLAN
1. Added louvers L-6 and L-7.
2. Added keyed note 16.

SHEET M201 – MECHANICAL PIPING FLOOR PLAN
Detail 1 – MECHANICAL PIPING FLOOR PLAN
1. Updated floor plan to reflect architectural changes.

SHEET M301 – MECHANICAL SECTIONS
Detail 2 – SHOP AREA DUCTWORK SECTION
1. Added manual balancing dampers in exhaust ducts.

SHEET M401 – MECHANICAL DETAILS
Detail 20 – DOAS-2 AND DOAS-3
1. Revised note on detail 20/M401.

SHEET M501 – MECHANICAL SCHEDULES
1. Added L-6 and L-7 to louver schedule.

PLUMBING
SHEET P101 – SANITARY SEWER PLAN
Detail 1 – SANITARY SEWER PLAN
1. Rerouted drain line at Wash Bay for new location of drain pits.
2. Added Keyed note number five.

SHEET P201 – DOMESTIC WATER PLAN
Detail 1 – DOMESTIC WATER PLAN
1. Rerouted domestic water mains to accommodate ceiling heights.

ELECTRICAL
SHEET E001 – ELECTRICAL NOTES, LEGEND, & INDEX
LIGHTING FIXTURE SCHEDULE
1. Revised model number of Lighting Fixtures “J thru J3” to remove the indirect lighting component.

SHEET E201 – ELECTRICAL LIGHTING PLAN
Detail 1 – ELECTRICAL LIGHTING PLAN
1. Updated floor plan to reflect architectural plan changes.

SHEET E301 – ELECTRICAL POWER & SYSTEMS PLAN
Detail 1 – ELECTRICAL POWER & SYSTEMS PLAN
1. Revised size of the generator.
2. Revised circuit numbers for air compressors and air dryers.
3. Revised circuit number for overhead crane.
4. Revised circuit numbers for 4-post and 2-post truck lifts.
5. Revised keyed notes.
6. Revised circuit numbers for generator battery charger and block heater.
7. Added keyed note for relocation of existing fiber optic conduit stub-up.

SHEET E302 – ELECTRICAL MEZZANINE AND ENLARGED PLANS
Detail 1 – ENLARGED ELECTRICAL ROOM
1. Added Panel “EQ1”.
2. Relocated electrical equipment around room.
3. Re-sized enclosure for Automatic Transfer Switch and panel “EDP”.

Detail 3 – FAB SHOP ENLARGED PLAN
1. Revised circuit number of Plasma Cutter.

SHEET E401 – HVAC EQUIPMENT POWER PLAN
Detail 1 – HVAC EQUIPMENT POWER PLAN

1. Added power for Louvers L-6 & L-7.
2. Revised keyed notes for louver/exhaust fan interlocking.
3. Added keyed note for louver/exhaust fan interlocking.

HVAC EQUIPMENT CIRCUIT SCHEDULE
1. Revised circuit numbers for DOAS-1 & DOAS-1 Pre-Heater.
2. Revised circuit numbers for HRU-1 & HRU-D1.
3. Added power for Louvers L-6 & L-7.

SHEET E501 – ELECTRICAL ONE-LINE DIAGRAM
Detail 1 – ELECTRICAL ONE-LINE DIAGRAM
1. Moved panels “MP1 & EQ1” from being fed from “EDP” to “MDP”.
2. Moved plasma cutter from being fed by “MDP”.
3. Revised breaker and feeder size for panel “EQ1”.
4. Revised breaker and feeder size for Normal and Emergency side of Automatic transfer switch.
5. Revised automatic transfer switch size.
6. Revised panel “EDP” rating and feeder size.
7. Added HRU-1 & HRU-D1 being fed from panel “EDP”.
8. Revised generator and generator breaker size.
9. Revised feeder for feeder tags #2 & #10.
10. Revised text for floor plan consistency.
11. Revised breaker and feeder size for panel “MP2”.

SHEET E501 – ELECTRICAL PANEL SCHEDULES
ALL PANELBOARD SCHEDULES
1. Revised interrupting rating of all panelboards.

PANEL SCHEDULE “MDP”
1. Revised breaker size for “EDP”.
2. Added “MP1” and “EQ1” to being fed from “MDP”.
3. Decreased feeder size for “EQ1”.

PANEL SCHEDULE “EDP”
1. Revised amperage rating and model number of the panelboard. Revised model number utilizes a smaller enclosure.
2. Added HRU-1 & HRU-D1 to being fed from “EDP”.
3. Increased feeder size for “MP2”.

PANEL SCHEDULE “EQ1”
1. Moved air compressors, air dryer, overhead crane, 4-post and 2-post truck lift circuits from panel.
2. Added plasma cutter, generator battery charger and block heater circuits to panel.
3. Revised amperage rating of the panelboard.

PANEL SCHEDULE “MP1”
1. Moved DOAS-1 and DOAS-1 Pre-heater circuits from panel.
2. Moved HRU-1 and HRU-D1 circuits from panel.

PANEL SCHEDULE “MP2”
1. Moved generator battery charger and block heater circuits from panel.
2. Added air compressor, overhead crane, 4-post and 2-post truck lifts, air dryer, DOAS-1, and DOAS-1 pre-heater circuits to panel.
3. Added louver L-6 and L-7 circuiting to panel.

FIRE PROTECTION

SHEET F101 – FIRE PROTECTION FLOOR PLAN

Detail 1 – FIRE PROTECTION FLOOR PLAN

1. Added keyed note 9.

End of ADD #1

1.01 Sealed bids for construction of a New Maintenance Shop Addition will be received until 2:00 PM, Local Time on Friday, March 14, 2025, in the Main Conference Room of the Craighead Electric Cooperative Corporation at 4314 Stadium Blvd, Jonesboro, AR 72404.

A. Bids will be received and reviewed by the Owner privately. They will not be opened publicly and read aloud.

B. Telephones and private office space **WILL NOT** be available for use by bidders.

1.02 There will be no pre-bid conference but contractors may schedule a site visit by contacting Jason Gazaway at Gazaway & White Commercial Real Estate, (870) 236-1115. **The Owner reserves the right to schedule any meetings.**

1.03 The work includes Site Preparation and Improvements, General Construction, Mechanical Work, Plumbing Work and Electrical Work, all to be let under one prime contract.

1.04 **Bid Security:** A cashier's check or acceptable bidder's bond payable to the Owner in an amount not less than 5% of the base bid submitted must accompany each bid as a guarantee that, if awarded the contract, the bidder will promptly enter into a contract and execute such bonds as may be required. If a Bid Bond is provided, the Bond must be signed by an authorized agent of the Bonding Company and the agent's power of attorney must be submitted with the Bid Bond.

1.05 Copies of drawings, specification and other proposed contract documents are on file and are open to inspection at the following places.

Wittenberg, Delony & Davidson, Inc.
Southern Reprographics Plan Room

1.06 Prime Bidders may obtain up to one (1) full-sized set of Bidding Documents from Southern Reprographics, Inc., 901 West 7th, Little Rock, Arkansas 72201, Tel: 501-372-4011, upon deposit by means of a credit/debit card, on account, or check in the amount of **$100** per set, payable to Wittenberg, Delony & Davidson, Inc. Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return paper Bidding Documents in good condition within ten (10) days after receipt of Bids. A Bidder receiving a Contract award may retain paper Bidding Documents, and the Bidder’s deposit will be refunded. Additional sets or partial sets of Bidding Documents, including addenda, may be obtained for the actual cost of printing, shipping and handling, and will be non-refundable. Prime Bidders may also obtain Bidding Documents in electronic format through Southern Reprographics at www.sriplanroom.com for a non-refundable fee as pre-determined by level of access.

1.07 Bidders, sub-bidders, material suppliers and other interested parties are encouraged to obtain complete sets of Bid Documents from the Architect. Complete sets of Bid Documents should always be used in preparing bids. Neither the Owner nor Architect assumes responsibility for errors in bidding or misinterpretations of Bid Documents resulting from the use of incomplete sets of Bid Documents. The documents obtained through the Architect are considered the official version and take precedence if any discrepancies occur. The use of incomplete or inaccurate Bid Documents does not relieve the bidder of the obligation to perform all work related to his bid as detailed in a complete set of Bid Documents.

1.10 All bidders shall conform to the requirements of Arkansas Code Annotated 17-25-101, Arkansas State Licensing Law for Contractors.

1.11 The Owner reserves the right to waive any formalities in, or to reject any or all bids.

1.12 No bidder may withdraw his bid within 60 days after the date of the opening thereof.

1.13 Each bid must be submitted in a sealed envelope bearing, on the outside, the name of the bidder, their Arkansas Contractor License number, their address and the project name.

END OF DOCUMENT 00 11 16

CRAIGHEAD ELECTRIC COOPERATIVE CORPORATION
NEW MAINTENANCE SHOP ADDITION
Bid Date: March 14, 2025
Bid Time: 2:00 PM
Jonesboro, Arkansas
WDD Project No.: 24-096

Proposal of _____
(Hereinafter called "Bidder"): (Strike Out Following Inapplicable Items)

1. An _____ Corporation,
   (State)
2. A Partnership, or

3. An Individual doing business as _____

To: **Craighead Electric Cooperative Corporation**

Gentlemen: Bidder, in compliance with bid solicitation for a **New Maintenance Shop Addition, Jonesboro, Arkansas**, having examined plans and specifications with related documents and site of the proposed Work, and being familiar with all conditions surrounding proposed project, including availability of materials and labor, hereby proposes to furnish labor, materials, and supplies, and construct project in accordance with Contract Documents, within time set forth therein, and at prices stated below. Prices are to cover all expenses incurred in performing Work required under Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on date specified in written "Notice to Proceed" and fully complete project within _____ consecutive calendar days.

Bidder acknowledges receipt of the following addenda:

No._____ Date:_____ No._____ Date:_____ No._____ Date:_____

No._____ Date:_____ No._____ Date:_____ No._____ Date:_____

BASE BID: Bidder agrees to perform all Work described in the Project Manual and shown on the

Drawings for the sum of _____

_____Dollars ($_____).

LIST OF UNIT PRICES

The Bidder shall **include in the Base Bid** the following lump sum allowances computed based upon the quantities listed and unit costs indicated. Unit prices include all Contractor cost including labor, material, General Conditions and overhead and profit. Bidder understands that the Owner reserves the right to review and or negotiate Unit Prices that are deemed to be not in accordance with current market value of proposed services.

In the event the actual quantities are greater or less than the given volumes, the unit prices stated will be used to adjust the contract accordingly.

1. **Unit Price No. 1:** Undercut and related replacement fill.

   Unit Price per Cubic Yard: $ _____ per CY

2. **Unit Price No. 2:** For importing, placing and compacting select fill material at undercut areas only. This is in addition to the fill material required to establish grades shown on the drawings which is to be included in the Base Bid.

   Unit Price per Cubic Yard: $ _____ per CY

LIST OF SUBCONTRACTORS

I, the undersigned General Contractor, certify that proposals from the following subcontractors were used in the preparation of my proposal. I agree that if I am the successful bidder, and if following subcontractors are approved, I will not enter into contracts with others for these divisions of the Work without written approval from Architect and Owner.

NAME: LICENSE NO.

MECHANICAL: _____

PLUMBING: _____

ELECTRICAL: _____

ROOFING AND SHEET METAL: _____

PRE-ENGINEERED STRUCTURE: _____

Bidder understands that Owner reserves right to reject any or all bids and to waive any formalities in the bidding. Bidder agrees bid shall be good and may not be withdrawn for period of sixty (60) days after scheduled closing time for receiving bids.

Upon receipt of written notice of acceptance of bid, Bidder will execute formal contract within ten (10) days and deliver Surety Bond or Bonds as required by Document 00 61 13.

Bid security attached in amount of 5% of base bid is to become property of Owner in event above contract and bond are not executed within time set forth above as liquidated damages and additional expenses to Owner.

By:_____ Date:_____

(Typed Name)

_____ Contractor License No._____

(Signature)

_____

(Title)

_____

(Business Address)

_____

(Seal - If bid is by a Corporation)

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CONTROL SEQUENCES

1.01 VRV FAN COIL UNITS (FC-01 THROUGH 09, AND HRU-1)

A. Mode of operation:

1. The unit shall be set and locked in auto mode at the thermostat so that both heating and cooling operation can occur as required to maintain the space temperature at setpoint. The system mode shall be either occupied or unoccupied based on a building automation system (BASs) schedule, an operator override command from the BAS, or a temporary occupancy override signal from the space temperature sensor. Commands or overrides from the BAS shall take priority over any local changes made at the space sensor.

B. Occupied mode:

1. The system shall allow for either local control (setpoint input at thermostat) or BAS control (setpoint input at BAS) of the setpoint. The space temperature sensor shall be set for a single occupied space cooling temperature setpoint. The occupied space temperature heating setpoint shall be calculated using an offset differential value of 3°F (adj). The initial occupied space temperature cooling setpoint shall be 72°F (adj). The initial occupied space heating setpoint is automatically set to 69°F based on the 3°F differential value. The occupied space temperature setpoint range shall be limited to within +/-2°F of the unoccupied space temperature setpoints.

2. The unit fan shall be on continuously during occupied operation.

3. On an increase in space temperature above the occupied space temperature setpoint, the unit electronic expansion valve shall modulate as required to maintain the space temperature at the unoccupied space temperature setpoint. Internal PID loop control of the electronic expansion valve should be utilized to minimize over/undershooting of the space temperature from setpoint.

4. Once cooling operation has been engaged, the unit shall not be allowed to enter into heating operation until the space temperature has fallen 1°F below the occupied space temperature setpoint for at least 15 min. If the space temperature falls more than 2°F below the occupied space

temperature setpoint, the 15 min guard timer delay shall be bypassed and the system shall switch from cooling operation to heating operation.

5. On a decrease in space temperature below the occupied space temperature setpoint, the unit electronic expansion valve shall modulate as required to maintain the space temperature at the unoccupied space temperature setpoint. Internal PID loop control of the electronic expansion valve should be utilized to minimize over/undershooting of the space temperature from setpoint. If the space temperature remains below heating setpoint with the vrv operating in full heating, the auxiliary heat shall be commanded on to meet the space temperature setpoint.

6. Once heating operation has been engaged, the unit shall not be allowed to enter into cooling operation until the space temperature has risen 1°F below the occupied space temperature setpoint for at least 15 min. If the space temperature rises more than 2°F above the occupied space temperature setpoint, the 15 min guard timer delay shall be bypassed and the system shall switch from heating operation to cooling operation.

C. Unoccupied mode:
1. During unoccupied operation, the system shall be subject to the unoccupied mode heating and cooling setpoints. The initial unoccupied heating setpoint shall be 65°F (adj). The initial unoccupied cooling setpoint shall be 80°F (adj).

2. The space temperature sensor shall be equipped with a temporary occupancy override feature that shall override the system into occupied mode for a period of 2 hours (adj).

D. Emergency power mode:
1. During emergency power mode, the BAS shall delay the start of HRU-1 by 30 seconds from the initiation of emergency power.

1.02 DOAS (DOAS-1 AND HRU-D1)

A. Airflow control: constant air volume
1. Supply air fan maintains constant speed to provide setpoint airflow rates for low and high-speed during operation time. Fan speeds will automatically adjust to compensate for changes in air density due to temperature fluctuations and to overcome filter loading.

B. Temperature and humidity control

1. Unit controller sends delta dew point value to Daikin's control box to adjust DX coil and HGRH coil valves to maintain set point for discharge air temperature and humidity control.

1.03 SHOP BAY VENTILATION

A. Occupied mode
   1. During the occupied mode, exhaust fans EF-4 and 5, along with DOAS-2 and 3, and HRU-D2 and D3 shall be energized. The dampers for associated intake louver l-2 and exhaust louver l-3 shall be opened. The damper for auxiliary intake louvers l-6 and 7 shall be closed.

B. Unoccupied mode
   1. During the unoccupied mode, exhaust fans EF-4 and 5, along with DOAS-2 and 3, and HRU-D2 and D3 shall be de-energize. The dampers for associated intake louver l-2, auxiliary intake louvers l-6 and 7 and exhaust louver l-3 shall be closed.

C. Emergency power mode
   1. During the emergency power mode, exhaust fans EF-4 and 5 shall be energized. The dampers for associated intake louver l-2, auxiliary intake louvers l-6 and 7, and exhaust louver l-3 shall be opened. DOAS-2 and 3, and HRU-D2 and D3 shall be de-energized.

1.04 FAB SHOP 102 WELDING HOOD

A. During welding or plasma cutting operations, exhaust fan EF-3 shall be manually energized using a wall mounted timer switch. The dampers for associated intake louver l-4 and exhaust louver l-5 shall be opened. When timer switch is off, exhaust fan EF-3 shall be de-energized and the dampers for louvers l-4 and 5 shall be closed.

1.05 STORAGE (IT) CLOSET 115

A. Exhaust fan EF-2 shall be thermostatically controlled with a wall mounted thermostat to 80°F(adjustable).

B. Space temperature shall be sensed by the BAS. If space temperature rises to 90°F, the BAS shall alarm.

1.06 RESTROOM EXHAUST FAN (EF-1)

A. OCCUPIED MODE

1. During the occupied mode, exhaust fan EF-1 shall be energized.

B. Unoccupied mode
1. During the unoccupied mode, exhaust fan EF-1 shall be de-energized.

1.07 ELECTRICAL ROOM 105

A. Mini-split heat pump (DSS/DHP-1) shall be thermostatically controlled to 80°F(adjustable).

1.08 FIRE RISER ROOM 106

A. Electric unit heater, EH-1, shall control space temperature to 80°F(adjustable) using a unit integral thermostat.

B. Space temperature shall be sensed by the BAS. If space temperature drops to 40°F, the BAS shall alarm.

1.09 WASH BAY 125

A. Electric unit heaters, EH-2, 3 and 4 shall control space temperature to 50°F(adjustable) using unit integral thermostats.

B. Space temperature shall be sensed by the BAS. If space temperature drops to 40°F, the BAS shall alarm.

END OF SECTION 23 09 93

SECTION 23 74 33

DEDICATED OUTDOOR AIR SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes Dedicated Outdoor Air System (DOAS) units for indoor applications.

1.02 SUBMITTALS

A. Product Data: Submit product data for specified products with the following information.

B. General layout drawing with plan and elevation views including all relevant dimensions.

C. Performance schedule including airflow, heating and cooling capacities, electrical data, unit weight.

D. Full fan curve.

E. Sound power data by octave band for all openings and radiated through the cabinet.

F. Electrical schematics including field wiring connections.

G. Component details including construction method and materials.

H. Control point schematic and complete written sequence of operation.

1.03 QUALITY ASSURANCE

A. Entire unit shall be UL 1995 certified and bear certification label by ETL, UL or CSA.

B. Unit shall meet ASHRAE Standard 90.1 performance requirements.

C. Unit sound data will be tested in accordance with AHRI 260.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store equipment away from construction areas where it may be damaged and protected from harmful weather conditions.

B. Keep factory shipping packaging in place until unit is ready to be installed.

C. Follow manufacturer's instructions for rigging and placement of equipment.

1.05 COORDINATION

A. Coordinate all system connections and building penetrations including electrical and duct connections.

1.06 WARRANTY

A. Standard Warranty for the Unit (Parts only): 24 months (2 years) from shipment date

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with project plans and specifications the following manufacturers are approved to supply products.
   1. Acceptable Manufacturers
      a. Oxygen8

B. DOAS Units
   1. DOAS units shall be factory assembled and tested. Units shall include insulated steel cabinet, split DX coil, split HGRH coil, electric heat, fan and motor assembly, filter rack, and integral controls.

C. CABINET
   1. Cabinet shall be nominal 1-inch double wall panel with R6.5 thermal insulation. Cabinet exterior shall be 22-gauge pre-painted steel that meets or exceeds 650-hour salt spray test based on ASTM B117. Liners and other steel components shall be galvanized steel. All seams shall be sealed to provide airtight casing.
   2. Doors shall be nominal 1-inch double wall panel with the same construction as cabinet. Doors shall be fitted with hinges and door handles. The doors shall have one lockable handle as standard.

D. The unit will be designed for service and maintenance on the bottom side for major components and front for filter and control panel access only to allow for a compact installation.

2.02 FILTERS

A. Unit shall include 2-inch filter rack for the outdoor air path upstream of the DX cooling coil. Filters shall be accessed through hinged filter access door. Supply one set of MERV 13 pleated filters for the outdoor air stream. All filters must be UL approved.

B. Provide factory mounted pressure sensors to measure filter pressure drop across filters. Pressure drop shall be digital feedback to controller for utilization in control and alarm sequencing. Unit controller shall monitor filter pressure level and report when filter changes are required.

2.03 FANS

A. Fans shall be mixed flow plenum type with direct drive motor. Fan and motor assembly shall be factory mounted and balanced. The fans will be capable of operating in ambient temperatures of up to 40°C.

B. Fan motors shall be permanent magnet, synchronous motor type with integral digital motor controller. Fan bearings shall be serviceable type with an L-10 life of 40,000 hours. Fan motors will be UL approved.

C. All fans shall be equipped with integral airflow monitoring system connected to the unit controller.

D. Provide means to easily remove fan-motor assembly for service through standard doors.

E. Fans should be designed such that all service can be performed in the field, including replacement of bearings.

F. Fan motor drives shall be 208/60/3 or 208-230/60/1 and be UL approved. Fans will be protected by UL approved motor protection circuit breaker.

2.04 ELECTRIC HEATING COIL

A. Provide open coil electric heaters of the size, capacity and performance shown in the equipment schedules.

B. All duct heaters shall be tested and certified to UL and CSA.

C. Frame to be corrosion-resistant and made of galvanized steel.

D. Coils shall be made of high-grade Nickel-Chrome alloy and shall be insulated from the frame by means of non-rotating ceramic bushings.

E. Heater to come with door mounted disconnect switch and air proving switch

F. SCR control is time proportioning type that modulates the heater and supplies the exact amount of power to match the demand. Input signal will be 0-10V.

G. Heaters shall be equipped with a fail-safe automatic reset disc-type thermal cut-out located in the top frame component above the heating element.

H. Duct heaters shall be non-sensitive to air flow direction and interchangeable for horizontal or vertical ducts without impairing safety.

2.05 DX HOT GAS REHEAT COIL

A. Where indicated, unit shall include AHRI 410 tested fin tube type DX coil for use with R-410A. Fins shall be aluminum with a minimum thickness of 0.0060". Tubes shall be 3/8" OD, 0.013" tube wall seamless copper tube mechanically expanded into fins. Coil shall have interlaced circuits to match remote condensing unit when required. Coil casings shall be galvanized steel. Coils shall include external drain and vent connections. Coil shall be mounted in a rack over a stainless-steel double sloped condensate pan. Coil shall be shipped with nitrogen holding charge and tested to 700 psi.

B. When VRV integration is used, the AHU integration controller (EKEQ) must be factory mounted and wired to EKEXV expansion valve kit.

C. Liquid and Gas thermistors are to be mounted to coil and wired to EKEQ kit in the factory.

D. EKEXV expansion valve kit will be mounted, and connections will be brazed to coil. Liquid and Gas lines to be capped at outside of AHU. Coil and EKEXV kit must be tested to 400 psi, and then nitrogen charged for shipment to site.

2.06 CONTROLS

A. Unit shall include an integrated microprocessor-based unit controller. The controls shall be located in the electrical panel. All unit controls shall operate off a transformer from the main power supply for single point power connection. All internal controls and sensors shall be factory prewired and tested.

B. The control system will regulate temperatures, airflows and other functions as required. Unit controller shall be pre-programmed with factory tested software for all possible functions.

C. The controller shall provide the following, refer to sequence of operation for specific unit control sequences;

1. Control of fans correcting for both changes in total static pressure and air density in both VAV and constant airflow applications.
2. Fan performance monitoring.
3. Ventilation airflow monitoring and control.
4. Airflow density correction for winter and summer conditions.
5. Energy recovery optimization including operation of bypass damper.
6. Supplemental heating and cooling when included.
7. Frost protection.
8. Monitoring alarms, faults and maintenance points including filter changeout.
9. Time and date schedules.
10. Humidity control.
11. Data logging and trending.

D. Include wireless capability that will allow the client to access remotely via internal wi-fi network.

E. If non factory controls are proposed as an option, a factory witness test is required to show integration and functionality.

F. Controller shall be BACnet IP and BTL certified and include Modbus communication. Communication shall include monitoring, control, alarms, faults and maintenance information.

G. Provide factory installed and tested contactors, overloads, fusing, starters motor speed controllers for supply fans. Include all necessary control transformers.

H. Provide unit mounted non-fused disconnect switch with single point power connection.

I. Supply all necessary temperature and pressure sensors complete with plug in wiring harnesses for proper option of unit.

J. When VRV integration is used, the AHU integration controller (EKEQ) must be factory mounted and wired to EKEXV expansion valve kit.

K. Liquid and Gas thermistors are to be mounted to coil and wired to EKEQ kit in the factory.

2.07 PLASTIC COMPONENTS

A. All plastic components that are in the airstream, must be of a UL94 rated material.

B. If gasketing is used to join unit sections together, gasketing must be a UL94 approved compound.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer instructions, these specifications, best practices, and all applicable building codes.

3.02 START UP SERVICE

A. Engage factory authorized service technician to start up and commission units. Provide start up report to owner.

END OF SECTION 260519

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Outdoor engine generator enclosure (where selected).
7. Vibration isolation devices (where applicable).

B. Related Requirements:

1. Section 26 36 23 "Automatic Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.02 DEFINITIONS

A. AEPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.

5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight for provided components; fuel tank, enclosure, silencer, base tank, each piece of equipment not integral to the engine generator.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams indicating terminal markings for engine generators and functional relationship between all electrical components.
7. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

1.04 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report. Perform tests at rated load and power factor. Provide the following test results:

    a. Maximum Power Level
    b. Maximum Motor Starting (sKVA)
    c. Structural Soundness
    d. Torsional Analysis
    e. Transient Response
    f. Alternator Temperature Rise
    g. Engine Cooling Requirements (unit mounted radiator)
    h. Harmonic Analysis (per IEEE-115 and ANSI-100)
    i. Voltage Regulation
    j. Endurance Testing
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, indicating evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions indicating compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control reports. Field start up report and unit in-service documentation, including load bank test results if applicable.

D. Generator shall be mounted and anchored to meet the requirements of Specification Section 26 04 48.16 “Seismic Controls for Electrical Systems”.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Include manufacturer's recommended maintenance and periodic testing plan in accordance with NFPA 110, Chapter 8.

B. Furnish extra materials required by local Authority Having Jurisdiction (AHJ) and defined in project documents that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.06 QUALITY ASSURANCE

A. The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in accordance with all applicable standards below:

1. CSA C22.2, No. 14-M91 Industrial Control Equipment.

2. CSA C22.2, No. 100 Motors and Generators
3. CSA 282-15
4. EN 61000-6
5. EN 55011
6. FCC Part 15 Subpart B
7. ISO 8528
8. IEC 61000
9. UL 508
10. UL 2200
11. UL 142
12. UL 6200
13. Designed to allow for installed compliance to NFPA 37, NFPA 70, NFPA 99 and NFPA 110

B. Manufacturer Qualifications:

1. Current certificate holder for ISO 9001 compliance.
2. The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 25 years and who maintains a service organization of factory-authorized generator technicians available twenty-four hours a day throughout the year.
3. Manufacturing and assembly of products must be done in the United States using domestically sourced materials to the extent practical.

C. Installer Qualifications: An authorized representative who is trained and certified by the manufacturer on stationary power systems.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty: 5 Year Comprehensive from date of Substantial Completion.
2. A Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period. A Limited warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for the first 2 years and then replacement parts for the remainder of the listed warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Generac Power Systems, Inc.; 150 kW, 6.7L with a K0250124Y21 - 250kW alternator. The Three Phase generator shall be rated for 150 kW at 208 volts and 60 Hz, at 0.8 power factor lagging while operating at a maximum ambient temperature of 110 Fahrenheit and maximum altitude of 6000 feet above sea level without reduction in electrical output capacity. Comparable products by one of the following will also be considered:

1. Kohler Power Systems.

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer. "Source Limitations: Obtain packaged engine generators and auxiliary components from single supplier. The equipment supplied and installed shall meet the requirements of NEC and all applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory certified service personnel.

C. Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data and a completed generator sizing model using the proposed manufacturer's generator sizing software shall accompany each request and authorized acceptance shall be addenda only. Should any substitutions be made, the contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

2.02 PERFORMANCE REQUIREMENTS

A. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 EPSS.

B. UL Compliance: Engine generator assembly and factory enclosure (if provided) shall be UL 2200 listed.

C. Engine Exhaust Emissions: Comply with applicable US EPA, State and Local Government requirements. Diesel Stationary Emergency: Engines shall be certified by the manufacturer to comply with 40 CFR Part 60 Subpart IIII.

2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Standby.

D. Service Load: The generator set shall be a Generac model 150 kW, 6.7L with a K0250124Y21 - 250kW alternator. It shall provide 150 kW and 187.5 kVA while operating at the maximum ambient operating temperature and elevation specified in the project documents.

E. Power Factor: 0.8 lagging.

F. Frequency: 60 Hz.

G. Voltage: 208 Volts ac.

H. Phase: Three Phase, Four Wire.

I. Induction Method: Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

L. Nameplates: For each major system component to identify manufacturer's name, model and serial number of component.

M. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 8.17 percent variation for 50 percent step-load increase or decrease at unity power factor. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 2.8 Hertz variation for 50 percent step-load increase or decrease at unity power factor. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined in accordance with NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start time to comply with NFPA system requirements.

2.04 ENGINE PERFORMANCE

A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15. Engine shall be capable of operating on hydrotreated vegetable oil blends (up to HVO 100) conforming to the EN 15940 specification without modification.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System to be engine mounted.
1. Oil filter shall be engine-mounted replaceable cartridge type with integral bypass valve, in accordance with manufacturer recommendations.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Jacket water heater shall be sized per NFPA110 and UL listed to ensure that genset will start within the specified time period and ambient conditions.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.
1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.

3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Maximum Ambient Operating Temperature on Radiator: 122 degrees F (50 degrees C).
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.
    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. Meets SAE 100R1A Type S, EN853 1SN, ISO 1436-1 Type 1SN
    c. a Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:
1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

G. Air-Intake Filter: Heavy duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12 or 24-V electric, with negative ground.
1. Cranking Cycle: As required by NFPA 110 for system level specified.
2. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle as required by NFPA 110 for system level specified.
3. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 minimum continuous rating.
4. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and NFPA 110 Section 5.6.4.6 for Level 1 systems.:

2.05 FUEL SYSTEM – DIESEL

A. Comply with NFPA 37.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel. Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 2 microns.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:

1. Tank level indicator.
2. Fuel-Tank Capacity: Sized for 24 running hours at 100% of rated generator load between fuel refills.
3. Leak detection in interstitial space.
4. Vandal-resistant fill cap.
5. Containment Provisions: Comply with requirements of authorities having jurisdiction. Secondary containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a primary tank rupture.
6. Normal and emergency vents on the main tank and secondary containment space, sized according to UL 142.

2.06 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

D. Control panel must comply with UL 6200. The controller shall meet ASTM B117 (salt spray test).

E. Connection to Building Management: Provide connections for data transmission of indications to remote data terminals via Modbus.

F. Environmentally Hardened Design: Open circuit boards, edge cards, and PC ribbon cable connections are unacceptable.

G. PCB Construction: Circuit boards with surface-mounted components to provide vibration durability. Circuit boards utilizing large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

H. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel powered from the engine generator battery.

I. Control and Monitoring Panel:

1. Digital engine generator controller with integrated touch screen, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.

2. Instruments: Located on the control and monitoring panel and viewable during operation.
   a. Engine lubricating-oil pressure gauge.
   b. Engine-coolant temperature gauge.
   c. DC voltmeter (alternator battery charging).
   d. Running-time meter.
   e. AC voltmeter, for each phase.
   f. AC ammeter, for each phase.
   g. AC frequency meter.
   h. Generator-voltage adjusting feature.

3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:
   a. Cranking control equipment.
   b. Run-Off-Auto switch.
   c. Control switch not in automatic position alarm.
   d. Overcrank alarm.
   e. Overcrank shutdown device.
   f. Low-water temperature alarm.
   g. High engine temperature pre-alarm.
   h. High engine temperature.
   i. High engine temperature shutdown device.
   j. Overspeed alarm.
   k. Overspeed shutdown device.
   l. Low fuel main tank.
      1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required for the indicated EPSS class.

m. Coolant low-level alarm.
n. Coolant low-level shutdown device.
o. Coolant high-temperature prealarm.
p. Coolant high-temperature alarm.
q. Coolant low-temperature alarm.
r. Coolant high-temperature shutdown device.
s. EPS load indicator.
t. Battery high-voltage alarm.
u. Low cranking voltage alarm.
v. Battery-charger malfunction alarm.
w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Remote manual stop shutdown device.
aa. Total engine run hours, non-resettable.
bb. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

J. External Alarm & Status Relays: Provide a separate terminal block, factory wired to Form C dry contacts, for each alarm and status condition required by Building Management or other external systems as shown on electrical drawings.

K. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

L. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Low water-temperature alarm.
3. High engine temperature pre-alarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.

13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Low-cranking voltage alarm.
19. Generator overcurrent-protective-device not-closed alarm.

M. Remote Emergency-Stop Switch: Provide remote emergency stop switch in quantity and style as shown on electrical drawings. Electrical contractor to coordinate exact location with engineer and local AHJ.

N. Data Logging:

1. Event Logging – the controller keeps a record of up to 8,000 events with date and time locally for warning and shutdown faults. This event log can be downloaded onto a USB storage device or onto a PC through the service program.
2. Event Snapshot – the control system shall capture 15 seconds of critical data around the time a fault or warning. This data shall be viewable on the controller and downloadable.
3. Data Logging – the controller shall allow customized parameters to be logged based on a start trigger from the controller interface.
    a. The parameters are selectable from all monitored parameters.
    b. The sample period shall be configurable from 1 second to 1 day.
    c. The collected data shall be stored on a USB storage device plugged into the control panel.

2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Unit mounted circuit breakers. Rating, ampacity, accessories, as shown on drawings or as listed below:

2. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:
   a. Tripping Characteristic: Designed specifically for generator protection.
   b. Trip Rating: Matched to generator output rating.
   c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
   d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Generator Controller Integrated Alternator Protective Functions:

1. Short-time I^2t function : Generator controller-based function shall continuously monitor current level in each phase of alternator output, integrate alternator heating effect over time, and predict when thermal damage of alternator will occur. As overcurrent heating effect on the alternator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits.
2. Long-time function: Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
3. Short-circuit fault clearing: Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Range: Provide range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity. Stator shall be skewed construction to minimize harmonic voltage distortion.

G. Enclosure: Drip proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator:

1. Voltage Regulator: Solid-state type, separate from exciter. The digital voltage regulator shall be microprocessor based with fully programmable operating and protection characteristics. The regulator shall maintain steady-state generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS. The regulator shall provide an adjustable Volts/Hz slope regulation characteristic in order to optimize voltage and frequency response for site conditions.
2. Alternator Excitation: Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
3. The generator must accept rated load in one-step.
4. Calculated Transient Voltage Performance: Motor starting performance and voltage dip determinations shall be based on the complete generator assembly. Voltage dip shall not exceed 15.4 percent based on the largest project block load, as determined by manufacturer's sizing program.
5. System Transient Voltage Performance: Alternator shall be capable of supplying 557 sKVA with a voltage dip not more than 35% at 0.3 starting power factor. Sustained voltage dip data or manufacturer-published SKVA numbers based on unity PF alternator-only dynamometer testing will not be accepted.
6. Calculated Transient Frequency Performance: Transient frequency dip performance shall be based on the complete generator set. Maintain frequency within 7.3 percent based on largest project block load, as determined by manufacturer's sizing program.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

2.09 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Basis of design is a Standard Weather Enclosure.

B. Generator packaged within manufacturer's weather protective, sound attenuated enclosure. Enclosure and generator set shall be UL 2200 Listed as a system.

C. Enclosure Construction: Minimum 14 gauge construction. Roof construction shall be raised-seam, gasket-free interlocking panels. Rivets shall not be used on external painted surfaces. Design shall be rodent resistant.

D. Doors shall be equipped with lift-off pin and sleeve type hinges to allow access to the engine, alternator, and control panel. Hinges shall be adjustable for door alignment. Hinges and all exposed fasteners shall be stainless steel. Each door shall be equipped with minimum 2-point latching mechanism and identical keys. Perimeter of all door openings shall include polyethylene gasket.

E. Upward discharging exhaust hood for engine cooling airflow and exhaust.

F. Engine exhaust silencer mounted within enclosure discharge hood.

G. Enclosure Finish: Electrostatic applied powered paint, baked and finished to manufacturer's specifications. Finish system shall be subjected to the following tests:

1. ASTM D1186 - 87; 2.5+ mil Paint Thickness
2. ASTM D3363 - 92a; Material Hardness
3. ASTM D522 - B; Resistance to Cracking
4. ASTM D3359 - B; Adhesion
5. ASTM B117 D 1654; Resistant to Salt Water Corrosion
6. ASTM D1735 D 1654; Resistant to Humidity
7. ASTM 2794 93 (2004); Impact Resistance
8. SAE J1690 - UV Protection"

H. Enclosure Color: Manufacturer's standard color, or custom color matched based on architect's design with color sample provided to generator manufacturer.

I. Wind Rating: Enclosure shall be constructed to attain basic wind speed rating of 110 MPH; WIF 1.15, Exposure Category "C", Building Classification "Enclosed", Topographic Factor Kzt = 1. Wind Design Pressures: windward, 20.6 lb/ft^2; leeward, -12.9 lb/ft^2; roof, -18.0 lb/ft^2."

J. Snow Load Rating: Minimum 70 pounds per square foot.

K. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.

L. Sound Insulation: Enclosure and air discharge hood completely lined with reflective silver mylar faced sound attenuating closed cell foam that meets UL 94 HF1 standards for flammability (FMVSS 302 test method). Roof sound insulation panels shall include additional mechanical retention.

M. Sound Performance: The engine generator, while operating at full rated load, shall not exceed 80.00 dBA average measured at 23 ft (7 meters) from the engine generator in a free field environment.

N. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.

O. Convenience Outlet: Factory-wired convenience 120v duplex-outlet within enclosure, GFCI.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment for units with a ratings 750kw or below.

1. Material: Standard neoprene separated by steel shims.

B. Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint for units with a rating larger than 750kw.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 0.5.

C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdowns.
9. Report factory test results within 10 days of completion of test.

2.12 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

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

3.02 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service in accordance with requirements indicated:

1. Notify Project Manager in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without written permission.

3.03 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases or steel dunnage as indicated on drawings.
2. Coordinate size and location of mounting bases for packaged engine generators.
3. Install unit with vibration isolation devices described in section 2.10.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections: The supplier of the electric generating plant and associated items covered herein shall provide factory certified technicians to inspect the completed installation and to perform an initial startup inspection to include:

1. Ensuring the engine starts (both hot and cold) within the specified time.
2. Verification of engine parameters within specification.
3. Verify no load frequency and voltage, adjusting if required.
4. Test all automatic shutdowns of the engine-generator.
5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

B. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

C. Battery and Charger Tests:

1. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions.
2. Verify that measurements are within manufacturer's specifications."

D. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest and reinspect as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

3.06 MAINTENANCE SERVICE

A. Repair Service Capabilities:

1. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including: engines, alternators, control systems, paralleling electronics, and power transfer equipment.
2. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 50 miles of the site.

3. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

B. Preventative Maintenance Service Agreement: The supplier shall include as a line item adder in the proposal, a one-year maintenance service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine generator set(s) and the transfer switch(es). This agreement shall include semi-annual preventative maintenance visits to verify operation and/or complete the following:

1. All periodic engine maintenance as recommended by the service manual.
2. All electrical controls maintenance and calibrations as recommended by the manufacturer.
3. All auxiliary equipment as a part of the emergency systems.
4. The supplier shall guarantee emergency service.
5. All expendable maintenance items are to be included in this agreement.
6. A copy of this agreement and a schedule shall be provided in the submittal documents, detailing scope of work and preventative maintenance service visit interval.

END OF SECTION 26 32 13

PART 1 - GENERAL

1.01 SCOPE

Furnish and install automatic transfer switch(es) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Basis of design is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch, Open - In Phase Transfer, 800 A, 3 Pole 4 Wire 480V, Transfer Switch in a NEMA 1 Enclosure. Each automatic transfer shall consist of a mechanically held power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.02 ACCEPTABLE MANUFACTURERS

Automatic transfer switches shall be Generac TX Series.

1.03 CODES AND STANDARDS

The automatic transfer switches and accessories shall conform to the requirements of:

A. UL 1008 - Standard for Automatic Transfer Switches
B. NFPA 70 - National Electrical Code (2017 version and later for start circuit monitoring)
C. NEC Articles 700, 701, 702, 708
D. NFPA 99 – Health Care Facilities
E. NFPA 110 – Emergency and Standby Power Systems
F. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
G. NEMA Standards ICS10, MG1, MG250, ICS6, AB1
H. ANSI C62.41
I. International Standards Organization: ISO 8528, 9001.
J. Where seismic rating and/or certification is required: IBC 2018, OSHPD

PART 2 – PRODUCTS

2.01 MECHANICALLY HELD TRANSFER SWITCH

A. The basis of design is the Generac TX Series Transfer switch that utilities a knife blade mechanically latching design with maintenance free contacts. The transfer switch unit shall be electrically operated and mechanically held. The open

transition switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency. The delayed transition switch shall be mechanically interlocked to ensure one of three possible positions, normal and emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. A manual operating handle shall be provided for maintenance purposes.

E. Designs utilizing components of or parts thereof which are not intended for continuous duty, repetitive switching, or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully rated AL-CU pressure connectors shall be provided.

H. The switch shall be capable of the following methods of transfer: Open with In-Phase transition only, Time Delay in Neutral transition, or In-Phase transition with a default to Time Delay in Neutral.

I. The transfer switch shall have a Seismic Certification to the requirements of the international Building Code of electrical equipment.

2.02 ATS CONTROL WITH INTEGRATED USER INTERFACE PANEL

A. The basis of design is the Generac TXC-100 Controller with Integrated User Interface Panel which is voltage agnostic for service purposes removing the need for technicians to carry and support control panels for every available voltage. Any manufacturers that provide a controller or control panel that does not meet this requirement should notify the consulting engineer before bidding.

B. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

C. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and include standard on-board serial communications capability.

D. A user accessible USB port shall be provided to facilitate firmware updates, uploading of switch operational parameters, downloading of event history and switch operational statistics. This USB port shall be front accessible without opening the ATS door.

E. The controller shall provide single and three phase capability for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.1Hz. Time delay settings shall be accurate to ±0.5% of the full-scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C.

F. The controller power supply shall be field-configurable to operate on 120V through 480V systems without the need for transformers.

G. Control logic shall be backed up with a rechargeable, user-replaceable lithium-ion battery that shall also maintain control power for up to 60 minutes in the event no source power is available.

H. The controller shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance.

I. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. IEC 61000 – 4 – 3 Radiated RF Field Immunity
2. IEC 61000 – 4 – 4 Electrical Fast Transient/Burst Immunity
3. IEC 61000 – 4 – 5 Surge Immunity
4. IEC 61000 – 4 – 6 Conducted RF Immunity
5. IEC 61000 – 4 -11 Voltage Dips and Interruptions
6. EN 61000 – 6 - 2 Industrial Immunity Requirements EN 61000-6-4 - Radiated Emissions
7. EN 61000 – 6 - 4 Conducted Emissions
8. CISPR 11 – Conducted RF Emissions and Radiated RF Emissions

2.03 ENCLOSURE

The basis of design is a Generac TX Series Non-Service Entrance Rated Transfer Switch in a NEMA 1 enclosure, with dimensions no larger than 78 Inches in Height, 30 Inches in

Width, and 24 Inches In Depth. Larger enclosures than the basis of design will need to be approved by the Consulting Engineer to ensure there is enough wall space and appropriate clearance.

A. Provide a temperature and humidity controlled anti-condensation heater for all NEMA 3R and 4X enclosed units. Heater shall be an available option on NEMA 1 enclosures, when called for on plans. Heater cover to indicate a hot surface.

B. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

C. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

PART 3 – OPERATIONS

3.01 CONTROLLER DISPLAY AND KEYPAD

A. A backlit four-line graphical LCD display and human interface shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the RS-485 communications port.

B. All instructions and controller settings shall be easily accessible, readable, and accomplished without the use of codes, calculations, or instruction manuals.

C. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.

D. The following parameters shall only be adjustable only by authorized service personnel:

1. Nominal line voltage and frequency
2. Single or three phase sensing on normal
3. Transfer operating mode configuration, (open transition, or delayed transition)

3.02 VOLTAGE AND FREQUENCY SENSING

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip settings capabilities; values shown as percentage of nominal unless otherwise specified.

Voltage and Frequency Settings	**Range**	**Default Value**
Source 1 (Normal) is Genset	Yes or No	No
Source 1 Undervoltage Dropout	50-97%	85%
Source 1 Undervoltage Pickup	52-99%	90%
Source 1 Overvoltage Dropout	105-120%	110%
Source 1 Overvoltage Pickup	103-118%	105%
Source 1 Underfrequency Dropout	90-97%	90%
Source 1 Underfrequency Pickup	91-99%	95%
Source 1 Overfrequency Dropout	103-110%	105%
Source 1 Overfrequency Pickup	101-109%	102%
Source 1 Voltage Imbalance Drop	5-20%	5%
Source 1 Voltage Imbalance Pickup	3-18%	3%
Source 1 Warmup Time	0-1800s	3s
Source 1 Cooldown Time	0-1800s	1800s
Source 1 Minimum Run Time	300-1800s	1200s
Source 2 is Generator	Yes or No	Yes
Source 2 Undervoltage Dropout	50-97%	85%

Source 2 Undervoltage Pickup	52-99%	90%
Source 2 Overvoltage Dropout	105-120%	110%
Source 2 Overvoltage Pickup	103-118%	105%
Source 2 Underfrequency Dropout	90-97%	90%
Source 2 Underfrequency Pickup	91-99%	99%
Source 2 Overfrequency Dropout	103-110%	105%
Source 2 Overfrequency Pickup	101-109%	102%
Source 2 Voltage Imbalance Drop	5-20%	5%
Source 2 Voltage Imbalance Pickup	3-18%	3%
Source 2 Minimum Run Time	300-1800s	1200s
Source 2 Warmup Time	0-1800s	3s
Source 2 Cooldown Time	0-1800s	1800s
Phase Rotation Check	ABC, CBA, OFF	ABC
Supply Overvoltage	350 VAC	Fixed
Manual Return to Normal	Yes or No	
Time Delay Settings		
Transfer to Emergency	120s max	30s
Re-transfer to Normal	1,800s max	1,800s
Time Delay Neutral	120s max	30s
Engine Cool Down	300-1,800s	1,800s
Delayed Transition Time	120s max	120s
Elevator Signal	120s max	30s

In Phase Transfer	Yes or No	
In Phase Synchronization	Time 60-3600s	300s
Preferred Source	S1, S2	S1
Voltage Imbalance Enable	Yes or No	
Voltage Imbalance Timeout	10-30s max	20s

B. Repetitive accuracy of all settings shall be within 1% at +25C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via RS-485 communications port access.

D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency.

E. The backlit graphical display shall have multiple language capability. Languages can be selected from the user interface.

3.03 TIME DELAYS

A. A **Line Interrupt** delay shall be provided to override momentary normal source outages, delay all transfer and engine starting signals; adjustable 0 to 120 seconds. It shall be possible to bypass the time delay from the controller user interface.

B. An **Engine Warm Up** delay shall be provided for extended engine RPM stabilization where fast transfer to the emergency source is not required; adjustable 0 to 1,800 seconds. It shall be possible to bypass the time delay from the controller user interface.

C. A **Transfer to Emergency** delay shall be provided for controlled sequencing of loads to the emergency source; adjustable from 0 to 120 seconds. It shall be possible to bypass the time delay from the controller user interface.

D. A **Retransfer to Normal** delay shall be provided to ensure stability of the normal source, adjustable from 0 to 1,800 seconds. Time delay shall be automatically bypassed if the emergency source fails and normal source is acceptable.

E. An **Engine Minimum Runtime** delay shall be provided to reduce nuisance starts when the normal source power is unstable but does not trigger a transfer to the emergency source, adjustable from 5 to 30 minutes. Operates in conjunction with Engine Cool Down delay.

F. An **Engine Cool Down** delay shall be provided; adjustable 300 – 1,800 seconds.

G. A **Delayed Transition** delay shall be provided to ensure sufficient time for motor voltage decay for transition between live sources; adjustable from 0 – 120 seconds.

H. An **Elevator Signal Before Transfer** output signal shall be provided to drive an external relay for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 120 second delay in any of the following modes:
   1. Prior to transfer only.
   2. Prior to and after transfer.
   3. Normal to emergency only.
   4. Emergency to normal only.
   5. Normal to emergency and emergency to normal.
   6. All transfer conditions or only when both sources are available.

I. For special applications (i.e., three sources), the option to select the **Preferred Source**.

J. All adjustable time delays shall be field adjustable without the use of special tools or software.

Time Delay Summary Table:

Time Delay Description	Range	Default Value
Line Interrupt Delay	0 – 120 sec.	3 sec.
Engine Warm Up Delay	0 – 1,800 sec.	3 sec.
Transfer to Emergency	0 – 120 sec.	3 sec.
Retransfer to Normal	0 – 1,800 sec.	1,800 sec.
Engine Minimum Run Time	5 – 30 min.	5 min.
Engine Cool Down	300 – 1,800 sec.	1,800 sec.
Delayed Transition (Center Off Position)	0 – 120 sec.	120 sec.
Elevator Signal Before Transfer	0 – 120 sec.	0 sec.
Preferred Source	Normal (S1), Emerg. (S2)	Normal (S1)

3.04 EXTERNAL CONTROL INTERFACES AND INDICATORS

A. Communications connectors, user interface and display shall be accessible and usable without presenting an arc-flash hazard.

B. Customer inputs shall be optically isolated for wider compatibility with external systems. This will protect the controller from external surges and transient voltages.

C. Surge Protection for the ATS controls shall be provided.

D. Replaceable fuses to protect the power supply to the ATS control panel.

E. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage **engine start** signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output and run for the duration of the Engine Minimum Runtime setting, regardless of whether the normal source restores before the load is transferred.

F. Engine starting contacts shall facilitate start-circuit monitoring to comply with the 2017 and later versions of NFPA 70 Article 700.10 (D)(3).

G. Two sets of Form-C auxiliary contacts rated 10 amps, 250 VAC shall be provided to indicate the switch actuator position, including center-off for Time Delay Neutral switches or a Permissive (Emergency Inhibit) condition.

H. A single **General Alarm** (summary alarm) indication shall light up the alert indicator and de-energize the configured common alarm output relay for external monitoring.

I. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source and one to indicate when the ATS is connected to the emergency source.

J. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency source, as determined by the voltage sensing trip and reset settings for each source.

K. LED indicating light shall be provided to indicate switch not in automatic mode (manual).

L. LED indicating light shall be provided to indicate any alarm condition.

M. The controller shall have two programmable inputs and one programmable output as standard; with an optional expansion board to add up to four programmable input/outputs. Programmable I/O conditions shall include:

Programmable Output	Programmable Input

Source 1 – Two Wire Start	Permissive (Emergency Inhibit)
Source 2 – Two Wire Start	Remote Engine Fast Test
Engine Exercising	Remote Engine Normal Test
Engine Warmup	ATS Timer
Signal Before Transfer	Initiate Demand Response
General Alarm	
Source 1 Good	
Source 2 Good	

N. System Status - The controller LCD display shall include a System Status screen which shall be accessible from any point in the menu system by depressing the "ESC" key until you arrive at the System Status screen. This screen shall display a clear description of the active operating sequences and switch position. Operational status information displayed shall include:
   1. Source 1 status (good or bad)
   2. Source 2 status (good or bad)
   3. Any active timer
   4. Permissive (Emergency Inhibit when active)

3.05 TRANSFER AND EXERCISE CONTROLS

The following standard features shall be built into the controller, capable of being activated through keypad programming as required by the user:

A. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

B. An engine generator exercising timer shall be provided to configure daily, day of week, weekly, bi-weekly, or monthly testing of an engine generator set at a specified time of day with or without load for a programmable period (Engine Minimum Runtime).

C. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency for remote test. Test signal can be enabled through the keypad or digital input. Transfer to emergency for demand response can be enabled by digital input.

D. **For In-Phase Transfer Switch Designs:** An in-phase monitor shall be provided in the controller such that the transfer occurs with less than ten degrees phase angle difference between sources. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents and shall not require external control of power sources. In-phase switch transfer time shall not exceed 25ms.

E. **For Delayed Transition Transfer Switch Designs:** Terminals shall be provided for a remote contact to signal the ATS to load-shed (Permissive is removed) and move to a center-off position. When the load-shed signal is removed (Permissive is restored), the ATS shall reclose to the emergency. If normal source is good during load-shed the ATS shall transfer to and remain on normal source.

3.06 DATA LOGGING AND DIAGNOSTICS

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual are not permissible.

A. Controller & Contactor Health Monitoring with visual and auxiliary contact status shall be provided.

B. Communications Interface – The controller shall be capable of interfacing, through a standard RS-485 serial communication port with a network of transfer switches.

C. Data Logging – The controller shall have the ability to log data and to maintain the last 200 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:
   1. Date, time and reason for transfer normal to emergency.
   2. Date, time and reason for transfer emergency to normal.
   3. Date, time and reason for engine start.
   4. Date and time engine stopped.
   5. Date and time emergency source available.
   6. Date and time emergency source not available.

PART 4 - ADDITIONAL FEATURES AND ACCESSORIES

4.01 ADDITIONAL OPTIONAL FEATURES

A. Line Interrupt Time Delay. - Not Selected

B. Integrating Metering with current transformer. - Not Selected

C. Manual Retransfer to Generator. - Not Selected

D. Permissive (Emergency Inhibit). - Not Selected

E. Chicago Toolkit. - Not Selected

F. Expanded Input/Output Module. - Not Selected

G. Pad Lockable Control. - Not Selected

H. Temperature and Humidity Controlled Heater for NEMA1. - Not Selected

I. Transient Voltage Surge Suppressor (TVSS). - Not Selected

PART 5 - ADDITIONAL REQUIREMENTS

5.01 WITHSTAND AND CLOSING RATINGS

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. The basis of design for this project is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch with a 100ka 3 Cycle Rating, 100ka (.05 seconds) Time Based Rating, and a 125ka Specific Breaker Rating transfer switches from other manufacturers with ratings less than provided in this section will need to be approved by the Consulting Engineer to ensure compatibility with the project.

B. Provide a temperature and humidity controlled anti-condensation heater for all NEMA 3R and 4X enclosed units. Heater shall be an available option on NEMA 1 enclosures, when called for on plans. Heater cover to indicate a hot surface.

C. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

D. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

5.02 TESTS AND CERTIFICATION

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.

B. The ATS manufacturer shall be certified to ISO 9001: 2015 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation, and servicing in accordance with ISO 9001: 2015.

5.03 SERVICE REPRESENTATION

A. The ATS manufacturer shall support a service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 10 years.

5.04 WARRANTY

A. The basis of design is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch Basic 2 Year Warranty.

B. A Basic Warranty is defined as the manufacturer covering replacement parts for the listed amount of the warranty period.

C. The Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period.

D. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

E. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

END OF SECTION 26 36 23

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1.01 Sealed bids for construction of a New Maintenance Shop Addition will be received until 2:00 PM, Local Time on Tuesday, March 11, 2025, in the Main Conference Room of the Craighead Electric Cooperative Corporation at 4314 Stadium Blvd, Jonesboro, AR 72404.

A. Bids will be received and reviewed by the Owner privately. They will not be opened publicly and read aloud.

B. Telephones and private office space **WILL NOT** be available for use by bidders.

1.02 There will be no pre-bid conference but contractors may schedule a site visit by contacting Jason Gazaway at Gazaway & White Commercial Real Estate, (870) 236-1115. **The Owner reserves the right to schedule any meetings.**

1.03 The work includes Site Preparation and Improvements, General Construction, Mechanical Work, Plumbing Work and Electrical Work, all to be let under one prime contract.

1.04 **Bid Security:** A cashier's check or acceptable bidder's bond payable to the Owner in an amount not less than 5% of the base bid submitted must accompany each bid as a guarantee that, if awarded the contract, the bidder will promptly enter into a contract and execute such bonds as may be required. If a Bid Bond is provided, the Bond must be signed by an authorized agent of the Bonding Company and the agent's power of attorney must be submitted with the Bid Bond.

1.05 Copies of drawings, specification and other proposed contract documents are on file and are open to inspection at the following places.

Wittenberg, Delony & Davidson, Inc.
Southern Reprographics Plan Room

1.06 Prime Bidders may obtain up to one (1) full-sized set of Bidding Documents from Southern Reprographics, Inc., 901 West 7th, Little Rock, Arkansas 72201, Tel: 501-372-4011, upon deposit by means of a credit/debit card, on account, or check in the amount of **$100** per set, payable to Wittenberg, Delony & Davidson, Inc. Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return paper Bidding Documents in good condition within ten (10) days after receipt of Bids. A Bidder receiving a Contract award may retain paper Bidding Documents, and the Bidder’s deposit will be refunded. Additional sets or partial sets of Bidding Documents, including addenda, may be obtained for the actual cost of printing, shipping and handling, and will be non-refundable. Prime Bidders may also obtain Bidding Documents in electronic format through Southern Reprographics at www.sriplanroom.com for a non-refundable fee as pre-determined by level of access.

1.07 Bidders, sub-bidders, material suppliers and other interested parties are encouraged to obtain complete sets of Bid Documents from the Architect. Complete sets of Bid Documents should always be used in preparing bids. Neither the Owner nor Architect assumes responsibility for errors in bidding or misinterpretations of Bid Documents resulting from the use of incomplete sets of Bid Documents. The documents obtained through the Architect are considered the official version and take precedence if any discrepancies occur. The use of incomplete or inaccurate Bid Documents does not relieve the bidder of the obligation to perform all work related to his bid as detailed in a complete set of Bid Documents.

1.10 All bidders shall conform to the requirements of Arkansas Code Annotated 17-25-101, Arkansas State Licensing Law for Contractors.

1.11 The Owner reserves the right to waive any formalities in, or to reject any or all bids.

1.12 No bidder may withdraw his bid within 60 days after the date of the opening thereof.

1.13 Each bid must be submitted in a sealed envelope bearing, on the outside, the name of the bidder, their Arkansas Contractor License number, their address and the project name.

END OF DOCUMENT 00 11 16

PART 1 - GENERAL

1.01 DESCRIPTION OF BID

A. Base Bid: Work includes Site Preparation and Improvements, General Construction, Mechanical Work and Electrical Work, as shown on the Drawings and described herein, all to be let under one prime contract.
   1. Reference AIA Document A701™ - 2018 Instructions to Bidders as may be applicable to competitively bid projects.

B. Bid Documents: Bidders, sub-bidders, material suppliers and other interested parties are encouraged to obtain complete sets of Bid Documents from the Architect. Complete sets of Bid Documents should always be used in preparing bids. Neither the Owner nor Architect assumes responsibility for errors in bidding or misinterpretations of Bid Documents resulting from the use of incomplete sets of Bid Documents. The documents obtained through the Architect are considered the official version and take precedence if any discrepancies occur. The use of incomplete or inaccurate Bid Documents does not relieve the bidder of the obligation to perform all work related to his bid as detailed in a complete set of Bid Documents.

1.02 EXAMINATION OF PREMISES

A. Before submitting his bid, Contractor will be held to have examined the premises and satisfied himself as to existing conditions under which he will be obligated to operate, or that will in any manner affect Work under this contract.

B. Bidder must inform himself fully of conditions relating to construction of project and employment of labor. Failure to do so does not relieve successful bidder of his obligation to furnish material and labor necessary to carry out provisions of his contract. Insofar as possible Contractor, in carrying out his Work, must employ such methods or means to avoid any interruption of or interference with Work of any other Contract.

1.03 CONTRACTOR'S LICENSE

A. Parties bidding on this Work must comply with all requirements and regulations of Contractor's License Law of the State of Arkansas, as set forth in Arkansas Code Annotated § 17-25-101 et. seq..

1.05 INTERPRETATIONS

A. No interpretation of plans, specifications or other bid documents will be made orally to any bidder. Requests for interpretation or clarification of Bid Documents must be made in writing addressed to **Wittenberg, Delony & Davidson, Inc.,**
ATTN: Gordon Duckworth, AIA, duck@wddarchitects.com.

1. **TO BE GIVEN CONSIDERATION, REQUESTS FOR INTERPRETATION MUST BE RECEIVED AT LEAST FIVE (5) WORKING DAYS PRIOR TO DATE FIXED FOR OPENING OF BIDS.**

B. Interpretations and supplemental information will be issued in the form of written addenda issued to prospective prime contract bidders. **ADDENDA WILL NOT BE ISSUED WITHIN THREE (3) WORKING DAYS (72 hours) PRIOR TO DATE FIXED FOR OPENING OF BIDS.** Failure of bidder to receive any addendum shall not relieve bidder from obligation under his bid as submitted. All addenda so issued shall become part of Contract Documents.

C. Should an error, inconsistency or omission be found in the Bid Documents after the Bid Opening, the Contractor will be deemed to have prepared his bid based upon the more costly or complex way of performing the Work or in accordance with the more stringent requirements.

D. Anything mentioned in the Specifications and not shown on the Drawings or shown on the Drawings and not mentioned in the Specifications is to have the same effect as if shown or mentioned in both.

E. Precedence **IS NOT** given to the Specifications over the Drawings or to Large Scale Drawings over Smaller Scale Drawings. All drawings and all specifications are complimentary and shall be viewed collectively when interpreting the Design Intent for the Project. The Architect is the sole judge and interpreter of Design Intent and his decision will be final and binding upon the General Contractor.

1.06 BID GUARANTY

A. Bid must be accompanied by bid guaranty of not less than five percent (5%) of the amount of bid, and at option of bidder may be cashiers check or bid bond secured by surety company and made payable to order of Owner. Bid guaranty shall insure execution of contract and furnishing of performance and payment bond or bonds by successful bidder.

1. If a Bid Bond is provided, the Bond must be signed by an authorized agent of the Bonding Company and the agent's power of attorney must be submitted with the Bid Bond.

1.07 OPENING OF BIDS

A. Refer to Construction Manager Trade packages.

1.08 WITHDRAWAL OF BIDS PRIOR TO BID OPENING

A. Refer to Construction Manager Trade packages.

1.09 QUALIFICATIONS OF BIDDER

A. Refer to Construction Manager Trade packages.

1.10 POWER OF ATTORNEY

A. Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

1.11 LAWS AND REGULATIONS

A. Bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and rules and regulations of authorities having jurisdiction over construction of project shall apply to contract throughout, and they will be deemed to be included in contract the same as though written out in full.

1.12 BID FORMALITIES AND REJECTION OF BIDS

A. Owner reserves right to waive any formalities in a bid or to reject any or all bids.

1.13 CONDITIONAL BIDS

A. Conditional bids will not be considered.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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PART 1 - GENERAL

1.01 SOILS REPORT

A. A geotechnical investigation of the site has been made for use in site grading and foundation design for this Project. This report has been bound herein for information purposes only. Boring logs and test data are for information only. Conditions are not intended as representations or warranties of accuracy or continuity between each soil boring. Architect and Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor and advise Contractor to make his own investigations as he deems necessary.

B. Additional boring tests and other exploratory operations may be performed by Contractor, at the Contractor's expense; however, no change in the Contract Sum will be authorized for such additional exploration.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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MTA ENGINEERS

- Geotechnical Engineering
- Materials Testing • Special Inspections
- Design

mtaengineers.com

GEOTECHNICAL ENGINEERING EXPLORATION

Craighead Electric Addition
Jonesboro, Arkansas

PREPARED FOR:

WDD Architects
5050 Northshore Lane
North Little Rock, AR 72118

PREPARED BY:

MTA ENGINEERS
8001 National Drive
Little Rock, AR 72209

July 19, 2024

MTA ENGINEERS

Corporate Office:
P.O. Box 23715 • Little Rock, AR 72221 • Ph. 501.753.2526
mtaengineers.com

Geotechnical Engineering • Materials Testing • Special Inspection • Design

Offices in: Little Rock, AR • Springdale, AR • Jonesboro, AR • Hoover, AL

WDD Architects
5050 Northshore Lane
North Little Rock, AR 72118

July 19, 202

Sent via email: chad@wddarchitects.com

Subject: Report of Geotechnical Engineering Exploration
Proposed Craighead Electric Improvement
Jonesboro, Arkansas

Att.: **Chad Young**

MTA Engineers has completed the authorized Geotechnical Engineering Exploration for the subject project. This work was conducted in accordance with the agreement between MTA Engineers and WDD Architects, which is detailed in MTA Engineers Proposal dated June 22, 2024.

The purpose of our work was to review general surface and subsurface conditions within the project site area, and to gather and present data relative to the design and construction of the proposed addition located in Jonesboro, Arkansas. This report outlines the exploration procedures used, exhibits the data obtained, and presents our recommendations.

MTA Engineers appreciates this opportunity to provide these services and looks forward to working with you on future projects. Please contact us if you have any questions or require additional information.

Sincerely,

MTA ENGINEERS

Serge Manzi
Geotechnical Staff Engineer
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Steve R. Garrett, Ph.D., P.E.
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STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
★ ★ ★
No. 8019
STEVEN RAY GARRETT

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EXECUTIVE SUMMARY

The geotechnical exploration was conducted at the existing Craighead electric Cooperative Corporation located in Jonesboro, Arkansas. At the time of our visit, the property was covered with grass in the proposed areas of the new building and pavement. The area of the new metal building shop is covered with gravel. In general, the soil consist of firm to very stiff lean clay layers. Subsurface conditions were consistent throughout the entirety of the project site.

Figure 1. General Topography of the Site

Major soil types encountered at each boring may be summarized as follow:

Table 1. Major Soil Types Encountered

SOIL TYPE	DESCRIPTION
CL	Tan-Gray, Lean Clay

See *Table 2. General Strata Classification of Boring Logs* or the individual boring logs found in Appendix B for a more detailed overview of the soils encountered on site. Based on the nature of the existing strata, the proposed subdivision should be at/or below existing grades.

Prior to the construction of any improvement, **the site should be grubbed/stripped off in the order of 6-in** in the area of organics. Based on the anticipated bearing load, it is recommended that the Empower building supported on shallow footings founded a minimum of **24-in** below final grade. Footings founded as accounted may be designed with an allowable bearing capacity of **3,000-psf** for continuous and/or individual spread footings. The metal shop building foundations, founded within **16-in** BGS, may be sized with a net bearing of **2,500-psf** for continuous and **3,000-psf** for individual spread footings.

The net allowable end bearing pressures are based on safety factors in excess of **3.0** with respect to the anticipated shear strength of the bearing stratum. Total and differential settlement is anticipated to be less than **½ -in.**

SUMMARY

- **Rock/Hard Dig:**
  - No hard dig material was encountered within the depth explored.
  - The use of mini excavators will be limited with depth.

- **Soils:**
  - The surface soils that contain organics should be stripped in the order of **6-in** BGS.
  - The soil strata will generally consist of firm to very stiff lean clay layers.
  - Potentially expensive "CH" layers were encountered at one location.
  - Fill/backfill, where needed, should consist of properly compacted select fill.
  - The native soils of Stratum I(a) are considered suitable for structural fill, if needed.

- **Foundations/Slabs:**
  - The new Empower Building should be supported on shallow footings founded a minimum of **24-in** BGS. A net bearing capacity of **3,000-psf** may be used for continuous and/or individual spread footings.
  - The metal shop building foundation, founded within **16-in** BGS, may be sized with a net bearing of **2,500-psf** and **3,000-psf** for continuous and individual footings, respectively.
  - Additional bearing recommendations are discussed further within this report.

- **Un-compacted Fill:**
  - No un-compacted material was encountered on the property during the exploration.

- **Stump/Organic Findings:**
  - The property is either covered with organics or gravel. The potential to find stumps or other organic material beneath the surface is low.

- **Pavement:**
  - Pavement should meet minimum city requirements in street widening areas.
  - A minimum of **3-in** of ACHM will be required in standard duty pavement sections.
  - Additional recommendations for pavement sections are presented within this report.
  - Subgrade soils should consist of the native soil of Stratum I(a) or the Structural fill.

- **Miscellaneous:**
  - Any buried utility on the property should be located prior to any excavation.
  - Drainage will need to be established prior to the start of any excavation and incorporated throughout the construction.

INTRODUCTION

This exploration was requested in order to evaluate existing subsurface conditions and provide geotechnical design recommendations. The results of this exploration and the geotechnical design recommendations for site construction are presented in this report.

Exploration was accomplished by:

1. Drilling **21** locations up to **20-ft** to explore subsurface soil and groundwater conditions.
2. Obtaining samples from each stratum, within the accessible areas, using standard geotechnical sampling technique or standard penetration test.
3. Performing laboratory tests on various samples to determine pertinent engineering properties of the subsurface strata.
4. Analyzing field and laboratory test data to develop design recommendations.

Note: The scope of this geotechnical exploration did not include an environmental assessment to determine the presence of wetlands and/ or hazardous or toxic materials in the soil or groundwater on or near this site. If there is concern of wetlands or a hazardous/ toxic material presence, a qualified environmental assessment consultant should be contacted to perform a site investigation before construction begins.

FIELD EXPLORATION

Subsurface conditions at the site were explored by using dry auger methods up to a depth of **20-ft** at **21** boring locations. The approximate boring locations are shown on the *Plan of Borings*, *Appendix A*. *Boring Logs* presenting descriptions of the soil strata encountered are included in *Appendix B.* Laboratory testing results of the different soil types are located in *Appendix D.*

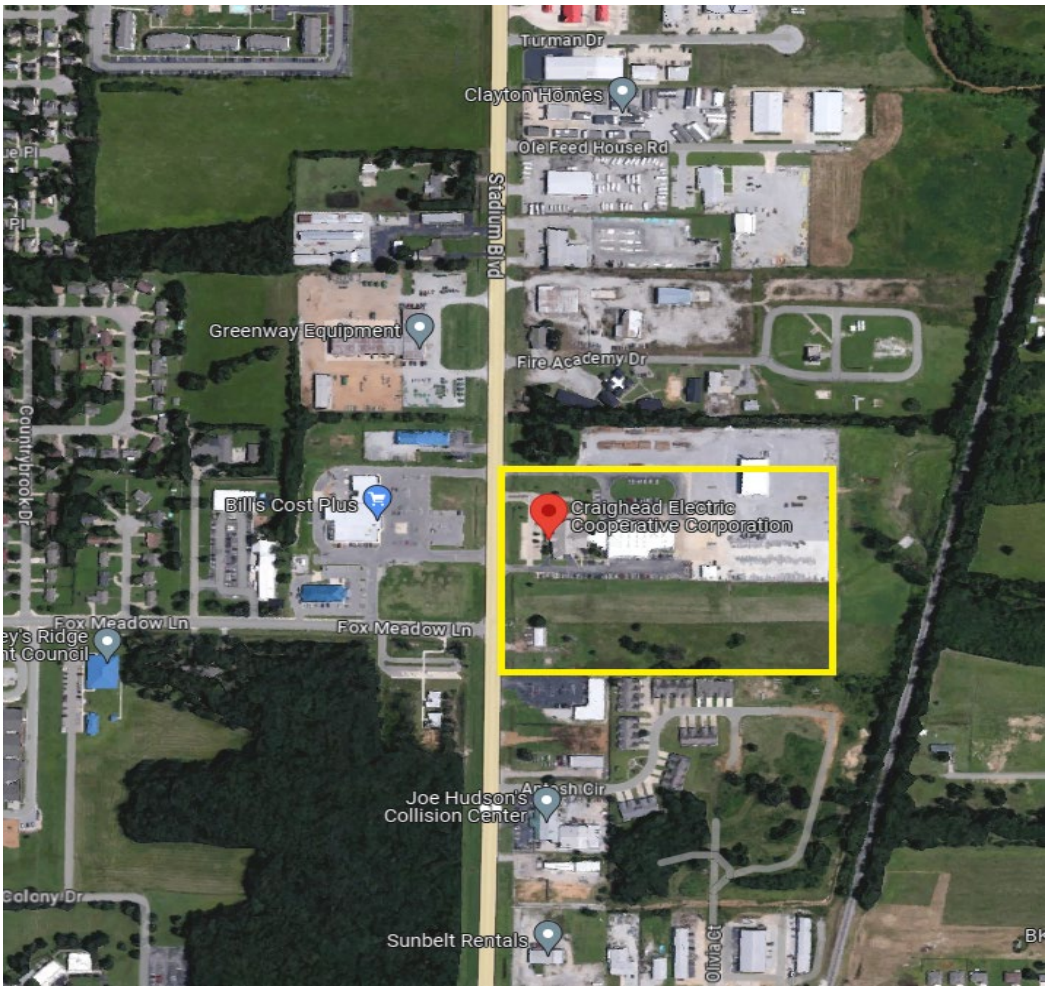
Samples were obtained throughout the entirety of most locations in general accordance with *Penetration Standard Sampling (SPT).* The recorded *N-Values* (Blows per foot) are indicated on the Boring Logs in the Blows per foot column. All soil samples encountered were removed from the field in moisture tight containers and transported to our laboratory for further examination.

At the lab, a visual classification was performed for each sample. All various soil types were then analyzed for specific engineering properties. The dry auger drilling procedures facilitated observation of shallow groundwater conditions. Groundwater was encountered within **2** to **18.5-ft** BGS in the area of the proposed Empower Building only. There is also a potential for increased groundwater to develop during rainy periods of the year.

GENERAL SITE AND SUBSURFACE CONDITION

This exploration was conducted on the site for the proposed addition located the existing Craighead Electric Cooperative in Jonesboro, Arkansas. The existing soils generally consisted of firm to very stiff lean clay layers in the primary grades and at depths. At the time of our visit, the proposed area of improvement was mainly covered with grass. The potential to find buried stumps or other organic material is low. Subsurface conditions were consistent throughout the entirety of the project site.

Figure 2. Site Investigated



It is anticipated that the proposed improvement will be placed at/or above existing grades to achieve proper drainage. Prior to the construction of any improvement or to the placement of any fill, the site should be stripped off in the order of **6-in** in the area of organics.

The stratigraphy encountered in the borings is summarized in Table 2. Subsurface conditions were consistent throughout the entirety of the proposed development. Borings were advanced up to a depth of **20-ft** within the area of the proposed addition using dry auger procedures. For a more detailed description of soils encountered while testing see the boring log sheets found in the attached preliminary report.

Table2. General Strata Classification of Boring Logs

	STRATA	DEPTH *(ft)*	GROUP SYMBOL	SOIL DESCRIPTION	SIGNIFICANT PROPERTIES
NEW EMPOWER BUILDING (B: 17, 18, 20, 21)	***3 to 6-in of Topsoil with Surface Organics & 4-in of ACHM + 12-in of Aggregate Base***				
	STRATUM I (a)	0 - 4 to 20	**CL**	• Tan-Gray, Lean Clay	• Very Stiff to Firm • Low Shrink Swell Potential • Light to Moderate Bearing
	STRATUM I (b)	0 to 4	**CH**	• Gray-Tan, High Plasticity Clay (in B-17)	• Firm to Stiff • Potentially Expensive
	• ***Groundwater:*** *2 to 18.5-ft BGS at all locations*			• ***Auger Refusal:*** *none achieved*	
NEW SHOP BUILDING (S: 1, 2, 3, 4, 5, 6)	**STRATA**	**DEPTH *(ft)***	**GROUP SYMBOL**	**SOIL DESCRIPTION**	**SIGNIFICANT PROPERTIES**
	5 to 15-in of Surface Gravel				
	STRATUM I	0 to 15	**CL**	• Tan-Gray, Lean Clay	• Firm to Very Stiff • Low Shrink Swell Potential • Light to Moderate Bearing
	• ***Groundwater:*** *none encountered*			• ***Auger Refusal:*** *none achieved*	
NEW PAVEMENT AREA (P: 7,8, 9, 10, 11, 12, 13, 14, 15, 16 & 22)	**STRATA**	**DEPTH *(ft)***	**GROUP SYMBOL**	**SOIL DESCRIPTION**	**SIGNIFICANT PROPERTIES**
	2 to 4-in of Topsoil with Surface Organics				
	STRATUM I (a)	0 to 10	**CL**	• Tan-Gray, Lean Clay/ Sandy Lean Clay	• Soft to Very Stiff • Low Shrink Swell Potential • Proper Subgrade Material
	STRATUM I (c)	0 to 10		• Tan-Gray, Sandy Lean Clay (in P:12 only)	
	• ***Groundwater:*** *none encountered*			• ***Auger Refusal:*** *none achieved*	

During our exploration, groundwater was encountered within **2 to 18.5-ft** in the area of the proposed Empower building. There is also a potential for increased groundwater to develop during wetter seasons of the year. The significant properties and characteristics of the subsurface strata pertinent to design and constructions are:

A. The topography of the site and planned building location.
B. The anticipated light bearing load.
C. The presence of stiff lean clay soils in the primary grades at all locations.
D. The anticipated pavement loading.

LABORATORY TESTING

Description of the soils encountered in the borings was prepared in general accordance with applicable ASTM standards. The soil stratification shown on the boring logs represents soil conditions at the specific boring locations. There may be some variations that occur between or beyond the boring locations.

The stratification lines on the boring logs represent the approximate boundaries between soil types, but the actual transitions between soil layers in the subsurface of the proposed site may be gradual. Laboratory testing was performed to verify/evaluate classification, volumetric stability, and to determine water content. The results of all testing performed are represented in Appendix D Laboratory Test Summary.

ANALYSIS AND RECOMMENDATIONS

SITE PREPARATION

The surface soils are mainly covered with organics. Prior to the construction of any improvement or the placement of any fill, it is recommended that the new Empower building and pavement areas should be stripped (grubbed) in the order of **6-in** to remove all organic containing soils in the area. The asphalt in the building area may be left in place as much as possible and perforated for vertical pore pressure transmission. Trapped water should be anticipated beneath the pavement during wet period.

Based on the nature of existing soils encountered at the time of exploration, it is recommended that the final grade be at/or above existing grades to achieve proper drainage. Upon stripping, the new pavement area should be proof-rolled using a loaded dump truck (or any **62,000-lbs** equivalent load) to assess the stability of the native soils. A representative of MTA Engineers should be present for the proof roll in order to evaluate and recommend mitigation of any unstable soils.

Due to the presence of random “CH” clay, care should be taken to ensure no “CH” clay is encountered within **3-ft** of any bearing surface. Backfill should be performed in accordance with the *Structural Fill* section of this report. Any required excavation should be performed under dry conditions if possible, using equipment adequate to perform the work. The use of mini excavators will be limited with depth.

Drainage will need to be established prior to the start of any excavation, and positive drainage should be maintained throughout this process. The addition of excessive moisture could cause a significant loss of soil stability. Groundwater was encountered in the new Empower building area. There is also a potential for increased groundwater to develop during wetter periods of the year, so consideration should be given to the incorporation of frequent French drains for the control of groundwater during wetter periods of the year.

STRUCTURAL FILL

Select fill, if needed, should consist of approved materials, free of organic matter and debris. For approval, samples of the proposed fill material should be submitted to MTA ENGINEERS for classification testing. Select fill consisting of low plasticity soil such as lean clay, clayey sand or clayey gravel, classifying as CL, SC, or GC according to the Unified Soils Classification System are generally considered suitable. High plasticity clay soils (soils with a Liquid Limit above **50**) should not be used as fill. Rock fragments that are greater than **6-in** should not be included in engineered fill within the top **2-ft** in pavement areas and within the top **4-ft** beneath the buildings.

Placement of approved fill should be achieved in multiple thin lifts. Each lift should not exceed eight **8-in** in loose thickness. Compaction of these lifts should be performed with suitable equipment to achieve **98%** of standard proctor (ASTM D-698) at **± 3%** of optimum moisture content. Care should be taken that all compaction recommendations are performed.

If cohesive soils are to be used, compaction should be performed using a kneading-type vibratory compactor, such as a vibratory sheepsfoot. The material should be broken down sufficiently to provide a dense matrix of particles. The following table should be used for compaction requirements based on material and location placed.

Note: The native soils of Stratum I(a) and Stratum I(c) are considered suitable for structural fill.

The following table should be used for compaction requirements based on material and location placed.

Table 3: Compaction Requirements

Material Type and Location	Minimum Compaction *(ASTM D-698)*	Allowable Variance in Moisture from Optimum
Structural Fill Beneath Pavement Sections	**98%**	**-3** to **+3**
Structural Fill Beneath Buildings	**98%**	**+3 -3** to **+3**
Utility Backfill in Building and Pavement Areas	**95%**	**-3** to **+3**
Miscellaneous and Green Areas	**90%**	**-3** to **+3**
Aggregate Base Course	**95%** (ASTM D-1557)	**-3** to **+3** (at time of Compaction)

BUILDING FOUNDATIONS

All foundations must satisfy two basic and independent design criteria. First, foundations must have an acceptable factor of safety against bearing failure under maximum design loads. Secondly, movement of the foundation due to consolidation, shrinkage, and/or swelling of the supporting strata should not exceed tolerable limits for the structure.

Construction factors such as installation of foundations units, excavation procedures, and surface and groundwater conditions should also be considered. The factors and the aforementioned subsurface conditions were influential in the development of the following recommendation. In view of the anticipated foundation loading and subsurface conditions encountered, it is recommended that the proposed structures be supported on a foundation system designed in accordance with the following recommendations.

FOUNDATIONS/ SLABS

Shallow Foundations

Based on the nature of the existing soil encountered at the time of exploration and the anticipated light loading, it is recommended that all structures be supported on traditional shallow footings. All footings should be founded within the firm to stiff native soils or the properly compacted structural fill. In addition, to minimize the potential for localized shear failure within the soils, a minimum footing width of **24-in** is recommended.

The Empower building may be supported on shallow footings founded a minimum of **24-in** BGS and may be designed using a net allowable end bearing pressure of **3,000-psf** for continuous and/or individual spread footings. The foundation for the new shop metal building may be founded a minimum of **16-in** BGS and sized using a bearing capacity of **2,500-psf** for continuous (strip) and **3,000-psf** for individual (spread) footings.

Due to the presence of random “CH” clay, care should be taken to ensure no “CH” clay is encountered within **3-ft** of any bearing surface. All bearing pressures are based on a factor of safety in excess of **3.0,** with respect to the anticipated shear strength of the bearing stratum. Total and differential settlement is anticipated to be no more than **½ -in**.

Slab-on-grade type construction is considered appropriate for the floor slab. We recommend that the slab be supported on **4-in** of clean crushed stone or gravel (ASTM C-33 #57 or equivalent) on prepared subgrade. A Class A impervious moisture barrier with a minimum thickness of **10-mils**, specified according to ASTM E-1745, should be provided between slab and the granular fill due to the potential for perched water to develop during the wetter seasons.

PAVEMENT DESIGN

Paved parking and drives will be constructed as part of the project. Design traffic volumes and loadings have not been determined. However, we anticipate that the drives will be subject to light vehicles and service trucks. It is also anticipated that the final subgrade elevation will be placed at/or above existing grades.

Prior to the construction of any improvement or the placement of any fill, the future pavement area should be stripped (undercut) in the order of **6-in** to remove all organic containing soil in the area. The potential to find stumps or other organic material beneath the surface is low.

The following design criteria were used to develop the recommended pavement sections in conjunction with the AASHTO Design Guide 1996:

Table 5. Pavement Design Assumption Values

PAVEMENT DESIGN ASSUMPTION VALUES	
Subgrade Type:	**Stratum I**
CBR	**5**
R-Value	**15**
Soil Support Value	**5**
Secant Modulus: *Es*	**4,800-psi**
Poisson's Ratio: *μ*	**0.35**
Subgrade Reaction Value: *K*	**230-pci**

Based on information obtained during this study, subgrade soils in the paved areas should consist of the in-situ clay layers of Stratum I(a), Stratum I(c) or the properly compacted Structural fill. Structural fill, where needed, should be placed as recommended in the *Structural Fill* section of this report.

It is recommended that positive site drainage should be provided during construction and be incorporated during the final design.

Table 6. Pavement Design Recommendations

PAVEMENT DESIGN RECOMMENDATIONS	
Standard Duty Asphalt Paving	**3-in** ACHM Surface Course
	8-in Crushed Stone Base Course
	12-in Compacted Select Fill
Heavy Duty Asphalt Paving	**4-in** ACHM Surface Course
	8-in Crushed Stone Base Course
	12-in Compacted Select Fill
Standard Duty Concrete Paving	**5-in** Concrete Pavement
	6-in Crushed Stone Base Course
	12-in Compacted Select Fill
Heavy Duty Concrete Paving	**6-in** Concrete Pavement
	6-in Crushed Stone Base Course
	12-in Compacted Select Fill
Dumpster Pad	**6-in** Concrete Pavement
	6-in Crushed Stone Base Course
	12-in Compacted Select Fill

Note: All pavement sections must comply with the city minimum requirements. It should be recognized that some periodic maintenance of pavement will be required. As a minimum, this should include periodic sealing of all joints and cracks to prevent surface water infiltration.

UN-COMPACTED FILL

No uncompacted fill material was encountered on the property during the exploration.

STUMP/ ORGANIC FINDINGS

The property was covered with grassy vegetation in most areas. The potential to find buried stumps below the surface is low.

SEISMIC CONSIDERATION

Based on IBC-2015, a site soil **Class D** may be used for design purposes. Liquefaction potential of the soils in Stratum I is negligible. Additional design information on Seismic Consideration is attached as Appendix E.

CONSTRUCTION PROCEDURES

There is a potential for increased groundwater to develop during wetter seasons. Therefore, foundations excavation and any other site grading should be performed during drier periods to reduce the possibility of changes in conditions.

Subsurface conditions significantly at variance with those encountered within the borings should be brought to the attention of the engineer, and work delayed pending evaluation and/or preparation of additional recommendations, if warranted.

♦ ♦ ♦ ♦

The following illustrations are attached and complete this report:

Appendix A: Plan of Excavation

Appendix B: Boring Logs

Appendix C: Key to terms and Symbols

Appendix D: Laboratory Test Results

Appendix E: Seismic Design Criteria

♦ ♦ ♦ ♦

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Appendix A:
Boring Location Plan

Midsouth Distributing USA
Craighead Electric Cooperative Corporation
4314 Stadium Blvd
B-1
B-2
B-3
B-4
B-5
B-6
7
8
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21
22
Image Landsat / Copernicus
Fox Meadow Center

Appendix B:
Boring Logs

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Boring Log Report

BORING NO. S-1
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM							8 7-5	12
			FIRM		16	26.3	39	23	93.8	2 3-4	7
5			STIFF **5-in OF SURFACE GRAVEL & TAN-GRAY, LEAN CLAY**							3 6-9	15
			VERY STIFF	CL						5 9-13	22
10			VERY STIFF							5 11-14	25
15			STIFF							5 7-11	18
			Boring Terminated								
20											
25											
30											

COMPLETION DEPTH: 15 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. S-2
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM							18 12-9	21
			FIRM							5 6-9	15
5			STIFF **7-in OF SURFACE GRAVEL & TAN-GRAY, LEAN CLAY**							5 14-17	31
			VERY STIFF	CL						7 11-15	26
			VERY STIFF							5 13-10	23
10											
15			VERY STIFF							6 9-6	15
			Boring Terminated								
20											
25											
30											

COMPLETION DEPTH: 15 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. S-3
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			VERY STIFF							11 22-7	29
			FIRM							3 5-7	12
5			STIFF		21	20.7	32	11	97.4	3 6-8	14
			5-in OF SURFACE GRAVEL & TAN-GRAY, LEAN CLAY							3 4-4	8
			FIRM	CL						3 4-8	12
10			FIRM							3 5-7	12
15			Boring Terminated								
20											
25											
30											

COMPLETION DEPTH: 15 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. S-4
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: EAST:
STATION:
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			VERY STIFF							13 26-14	40
			FIRM							3 5-8	13
5			STIFF							3 6-8	14
			5-in OF SURFACE GRAVEL **TAN-GRAY, LEAN CLAY** FIRM	CL						6 7-9	16
			FIRM							4 5-7	12
10											
15			FIRM							3 5-7	12
			Boring Terminated								
20											
25											
30											

COMPLETION DEPTH: 15 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. S-5
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			DENSE							19 30-9	39
			STIFF							4 7-9	16
5			STIFF **10-in OF SURFACE GRAVEL**							3 7-11	18
			VERY STIFF **TAN-GRAY, LEAN CLAY**	CL						4 9-11	20
10			VERY STIFF							5 9-12	21
15			FIRM							4 4-6	10
			Boring Terminated								
20											
25											
30											

COMPLETION DEPTH: 15 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. S-6
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			DENSE							15 18-13	31
			FIRM		21	23.0	36	15	94.1	2 5-7	12
5			STIFF **15-in OF SURFACE GRAVEL**							3 7-9	16
			STIFF **TAN-GRAY, LEAN CLAY**	CL						5 7-9	16
			STIFF							6 9-8	17
10											
15			FIRM							4 6-6	12
			Boring Terminated								
20											
25											
30											

COMPLETION DEPTH: 15 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM, MOIST		21	14.8	51	30	92.2	3 4-4	8
			6-in OF SURFACE ORGANICS & TAN-GRAY, FAT CLAY	CH						5 9-8	17
			STIFF, MOIST								
5			STIFF, MOIST							5 7-6	13
			STIFF, MOIST							4 6-7	13
			STIFF, MOIST							4 8-11	19
10			**TAN-GRAY, LEAN CLAY**	CL							
15			STIFF, MOIST							5 8-9	17
20			FIRM, WET							5 3-4	7
			Boring Terminated								
25											
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 18 AFTER 24 HOURS: 18

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PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			SURFACE ELEVATION: EXISTING GRADE								
			FIRM, MOIST							4 5-4	9
			VERY STIFF, MOIST							9 14-15	29
5			VERY STIFF, MOIST							5 10-10	20
			STIFF, MOIST **4-in OF SURFACE ORGANICS & TAN-GRAY, LEAN CLAY**							5 8-8	16
			STIFF, MOIST							5 7-12	19
10				CL							
15			FIRM, MOIST							6 5-7	12
			FIRM, WET							3 4-4	8
20											
			Boring Terminated								
25											
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 18.5 AFTER 24 HOURS: 18.5

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PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM							4 5-4	9
			VERY STIFF, MOIST		21	21.5	42	21	97.9	9 14-15	29
5			VERY STIFF, MOIST							5 10-10	20
			3-in OF SURFACE ORGANICS & TAN-GRAY, LEAN CLAY							5 8-8	16
			STIFF, MOIST							5 7-12	19
10			STIFF, MOIST	CL							
15			FIRM, WET							6 5-7	12
20			FIRM, WET							3 4-4	8
25			Boring Terminated								
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 13 AFTER 24 HOURS: 13

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JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			4-in OF ACHM & 12-in AGG. BASE	PVMT							
			STIFF, WET @ 2-ft							7 9-9	18
5			STIFF, MOIST							3 8-10	18
			STIFF, MOIST **TAN-GRAY, LEAN CLAY**		18	19.8	37	19	98.3	5 5-8	13
10			VERY STIFF, MOIST	CL						8 11-12	23
15			STIFF, MOIST							5 8-8	16
20			FIRM, WET							4 4-7	11
25			Boring Terminated								
30											

COMPLETION DEPTH: 20 WATER DEPTH> INITIAL: 2 AFTER 24 HOURS: 2

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BORING NO. P-7
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM		18	16.8	36	18	85.7	4 3-4	7
			VERY STIFF							7 11-11	22
5			**4-in OF SURFACE ORGANICS & TAN-GRAY, LEAN CLAY WITH TRACE FINE SAND** STIFF	CL						5 6-7	13
			FIRM							3 5-6	11
10			VERY STIFF							5 8-12	20
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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BORING NO. P-8
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM							5 6-3	9
			VERY STIFF							5 10-13	23
5			STIFF **3-in OF SURFACE ORGANICS & TAN-GRAY, LEAN CLAY**	CL						7 9-10	19
			STIFF							3 6-7	13
10			STIFF							6 8-11	19
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. P-9
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: EAST:
STATION:
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			STIFF							5 7-8	15
			VERY STIFF							8 21-24	45
			3-in OF SURFACE ORGANICS								
5			VERY STIFF **& TAN-GRAY, LEAN CLAY**	CL						11 15-19	34
			STIFF							5 9-8	17
			STIFF, MOIST							5 4-9	13
10											
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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Boring Log Report

BORING NO. P-10
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM		15	16.2	33	18	90.3	3 4-4	8
			STIFF							7 8-8	16
5			**3-in OF SURFACE ORGANICS & TAN-GRAY, LEAN CLAY** FIRM	CL						4 5-7	12
			FIRM							3 5-5	10
10			FIRM							3 5-7	12
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. P-11
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM							3 4-3	7
			STIFF							5 13-14	27
5			**4-in OF SURFACE ORGANICS** FIRM **& TAN-GRAY, LEAN CLAY**	CL						4 6-9	15
			FIRM							3 5-7	12
10			FIRM							4 7-9	16
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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Boring Log Report

BORING NO. P-12
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			SOFT		20	16.7	35	15	67.1	2 2-3	5
			VERY STIFF							5 11-16	27
5			**TAN-GRAY, SANDY LEAN CLAY** VERY STIFF	CL						8 11-12	23
			FIRM							4 5-7	12
10			VERY STIFF							5 7-14	21
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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Boring Log Report

BORING NO. P-13
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: EAST:
STATION:
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM							3 4-2	6
			VERY STIFF							8 11-15	26
5			**2-in SURFACE ORGANICS & TAN-GRAY, LEAN CLAY** VERY STIFF	CL						7 13-14	27
			STIFF							4 8-10	18
10			VERY STIFF							6 11-14	25
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. P-14
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: EAST:
STATION:
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM		17	21.5	30	13	95.3	2 3-2	5
			VERY STIFF **3-in SURFACE ORGANICS & TAN-GRAY, LEAN CLAY**							4 8-9	17
5			VERY STIFF	CL						3 13-10	23
			STIFF							4 8-10	18
10			VERY STIFF							6 11-14	25
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

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BORING NO. P-15
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM		17	21.5	30	13	95.3	2 3-4	7
			VERY STIFF							6 18-20	38
5			**4-in SURFACE ORGANICS** VERY STIFF **& TAN-GRAY, LEAN CLAY**	CL						6 12-15	27
			STIFF							5 8-10	18
10			STIFF							3 6-8	14
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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BORING NO. P-16
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: _____ EAST: _____
STATION: _____
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM		22	14.9	46	24	92.4	3 4-3	7
			VERY STIFF							9 14-16	30
5			**2-in SURFACE ORGANICS** STIFF **& TAN-GRAY, LEAN CLAY**	CL						6 9-10	19
			STIFF							4 6-8	14
10			STIFF							6 7-12	19
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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Boring Log Report

BORING NO. P-22
PAGE 1 OF 1

JOB NO. GEO24-100
JOB NAME: CRAIGHEAD ELECTRIC AADITION
COORDINATES: NORTH: EAST:
STATION:
LOCATION: JONESBORO, AR

DATE: 7/09/24
TYPE OF DRILLING: DRY AUGER
EQUIPMENT: GEOPROBE 7822DT
LOGGED BY: ERIC
DRILLED BY: MYCKEL

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: EXISTING GRADE	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	PLASTICITY INDEX	PERCENT PASSING #200	NO. OF BLOWS PER 6-IN.	N-Value
			FIRM		17	21.5	30	13	95.3	3 5-3	8
			VERY STIFF							6 12-15	27
5			**3-in SURFACE ORGANICS & TAN-GRAY, LEAN CLAY** STIFF	CL						5 11-7	18
			VERY STIFF							6 7-13	20
10			FIRM							2 3-8	11
			Boring Terminated								
15											
20											
25											
30											

COMPLETION DEPTH: 10 WATER DEPTH> INITIAL: AFTER 24 HOURS:

REMARKS:

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Appendix C:
Key to Terms

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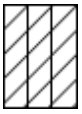
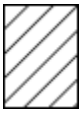
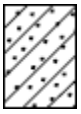
TERMS AND SYMBOLS USED ON BORING LOGS

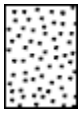
SOIL TYPES

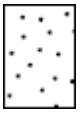
CLAY (CH)

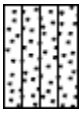

SILTY CLAY (CL)


CLAY (CL)

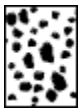

SANDY CLAY (CL)

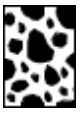

WELL-GRADED SAND (SW)

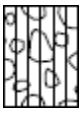

POORLY-GRADED SAND (SP)


SILTY SAND (SM)

CLAYEY SAND (SC)

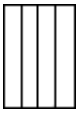

WELL-GRADED GRAVEL (GW)

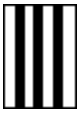

POORLY-GRADED GRAVEL (GP)

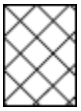

SILTY GRAVEL (GM)

SANDY SILT (ML)

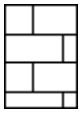
CLAYEY GRAVEL (GC)


SILT (ML)

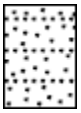

SILT (MH)

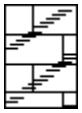

FILL MATERIAL

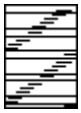
ROCK TYPES

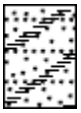

LIMESTONE

SHALE


SANDSTONE

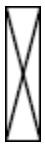

WEATHERED LIMESTONE


WEATHERED SHALE


WEATHERED SANDSTONE

SAMPLER TYPE

SHELBY TUBE SAMPLE


SPLIT SPOON SAMPLE

AUGER SAMPLE

NO RECOVERY

MTA ENGINEERS
P.O. Box 23715 • Little Rock, AR 72221, Ph. 501.753.2526

SOIL GRAIN SIZE

U.S. STANDARD SIEVE								
12"	3"	3/4"	4	10	40	200		
BOULDERS	**COBBLES**	**GRAVEL**		**SAND**			**SILT**	**CLAY**
		COARSE	**FINE**	**COARSE**	**MEDIUM**	**FINE**		
304	76.2	19.1	4.75	2	0.42	0.074	0.002	
SOIL GRAIN SIZE IN MILIMETERS								

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No 200 sieve): Includes (1) clean gravels and sands, and (2) silty clayey gravels and sands condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERMS	N VALUE	RELATIVE DENSITY
VERY LOOSE	0-4	0 – 15 %
LOOSE	4-10	15 – 35 %
MEDIUM DENSE	10-30	35 – 65 %
DENSE	30-50	65 – 85 %
VERY DENSE	50 and above	85 – 100 %

FINE GRAINED SOILS (major portion passing No 200 sieve): include (1) inorganic and organic silt and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer reading or by unconfined compression tests.

DESCRIPTIVE TERMS	N VALUE	UNCONFINED COMPRESSIVE STRENGTH TON / SQ. FT.
VERY SOFT	0-3	less than 0.25
SOFT	3-6	0.25 - 0.50
FIRM	6-12	0.50 - 1.00
STIFF	13-20	1.00 - 2.00
VERY STIFF	20-50	2.00- 4.00
HARD	50 and above	4.00 and higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above because of planes of weakness or cracks in the soil. The consistency rating of such soils are based on penetrometer readings

TERMS CHARACTERIZING MOISTURE CONTENT

DRY: No water evident in sample; fines less than plastic limit.
MOIST: Sample feels damp; fines near the plastic limit.
VERY MOIST: Water visible on sample; fines greater than plastic limit and less than liquid limit.
WET: Sample bears free water; fines greater than liquid limit.

TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED: Having inclined planes of weakness that are slick and glassy in appearance.
FISSURED: Containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
LAMINATED: Composed of thin layer of varying color and texture.
INTERBEDDED: Composed of alternate layers of different soil types
CALCAREOUS: Containing appreciable quantities of calcium carbonate.
WELL GRADED: Having wide range in grain sizes and substantial amounts of all intermediate particle size.
POORLY GRADED: Predominantly of one grain size, or having a range of sizes with some intermediate size missing

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with UNIFIED SOIL CLASSIFICATION SYSTEM as described in technical Memorandum No 3-357, Waterways Experiment Station, March 1953

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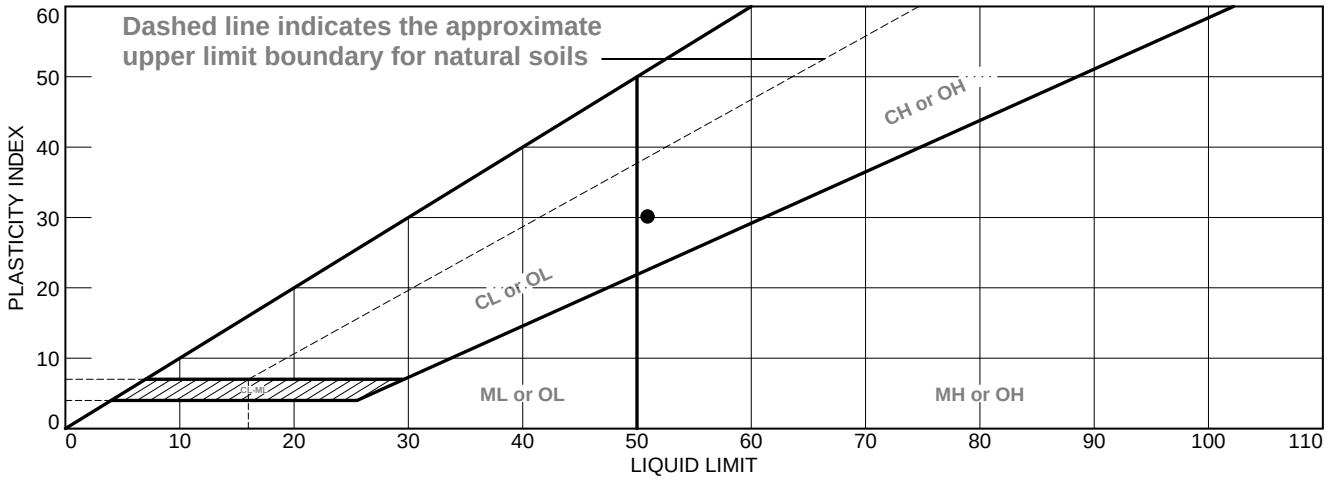
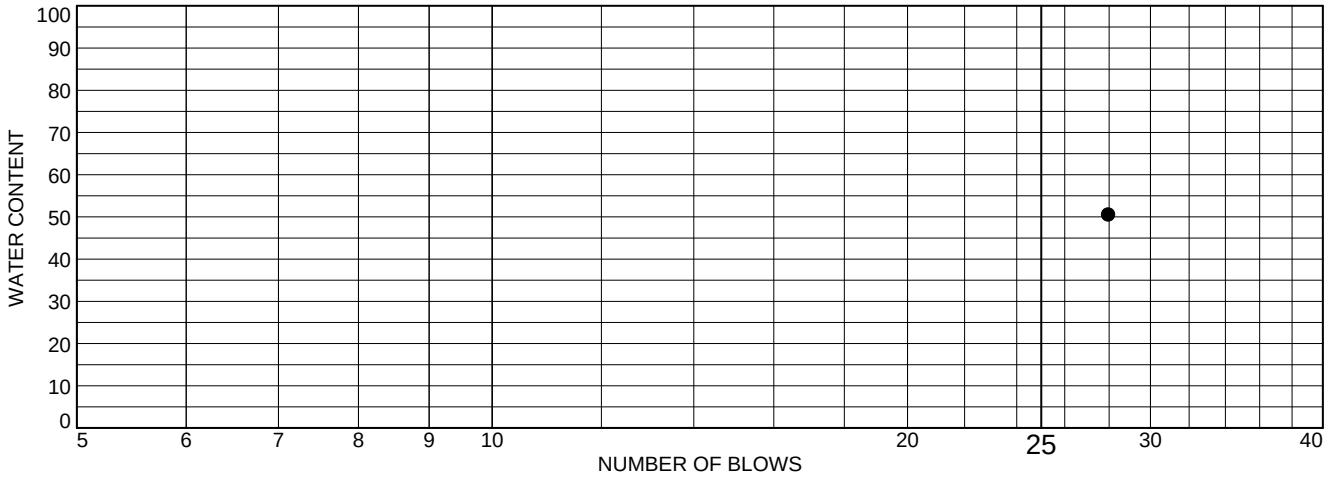
Appendix D:
Laboratory Test Summary

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, HIGH PLASTICITY CLAY	51	21	30	94.8	92.2	CH

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** B-17 **Depth:** 0

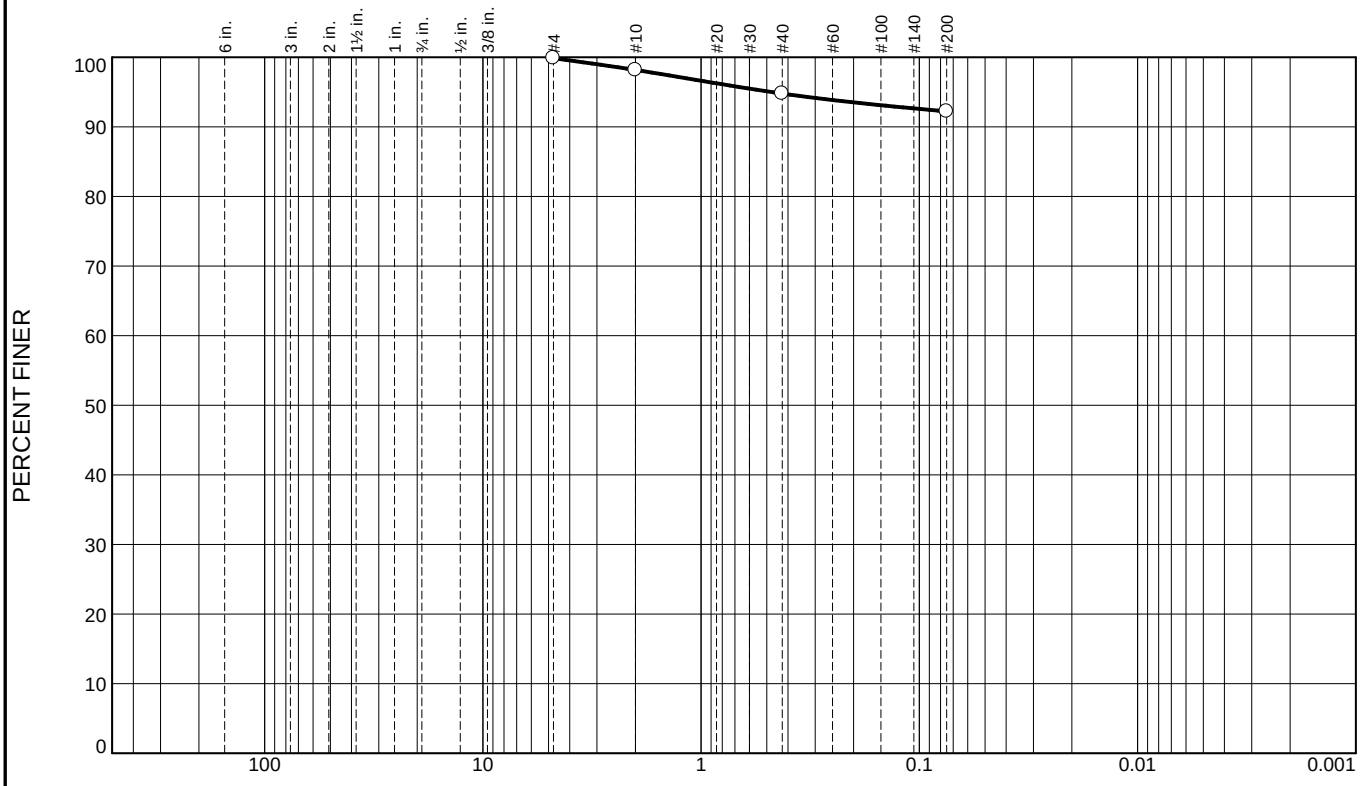
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			1.7	3.4	2.6	92.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.9		
#10	98.2		
#40	94.8		
#200	92.2		

* (no specification provided)

Material Description

TAN-GRAY, HIGH PLASTICITY CLAY

Atterberg Limits

PL= 21 LL= 51 PI= 30

Classification

USCS= CH AASHTO= A-7-6(30)

Remarks

Source of Sample: B-17 **Depth:** 0

Date:

Materials Testing of Arkansas

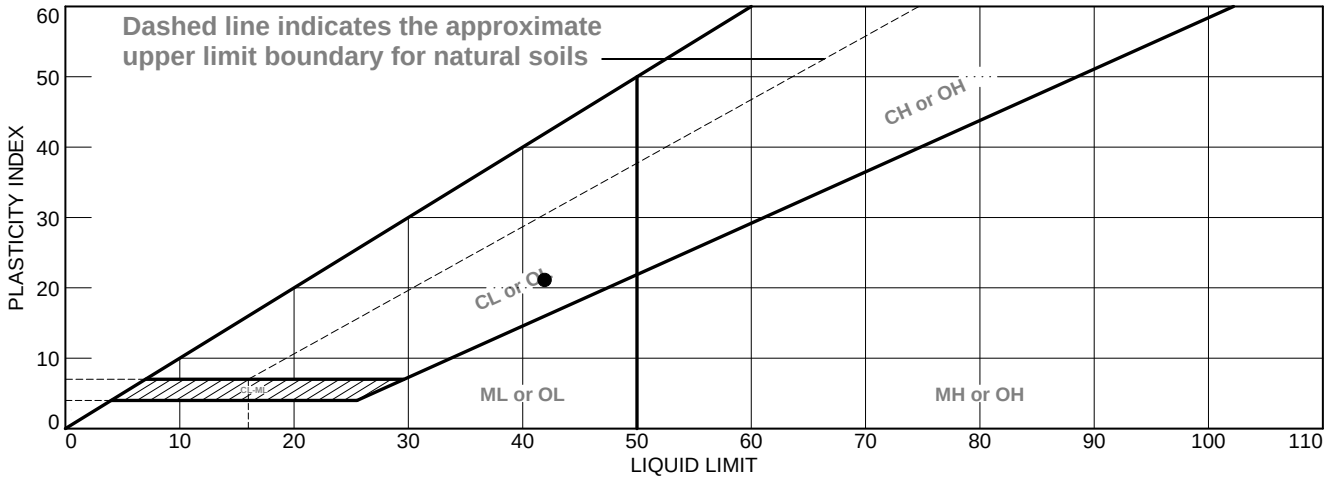
Little Rock, AR

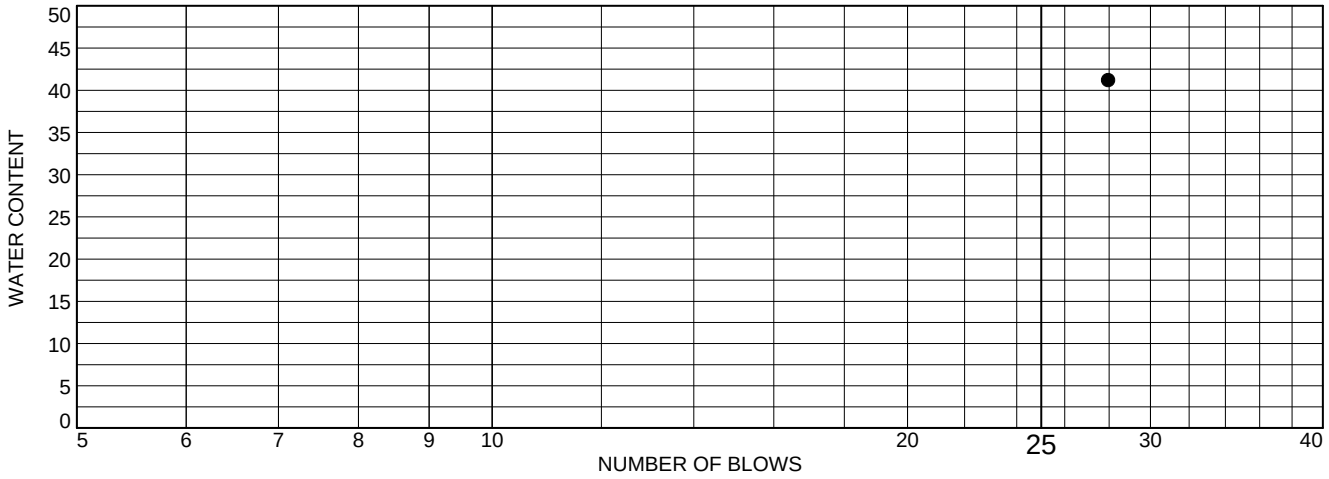
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	42	21	21	98.8	97.9	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** B-20 **Depth:** 2

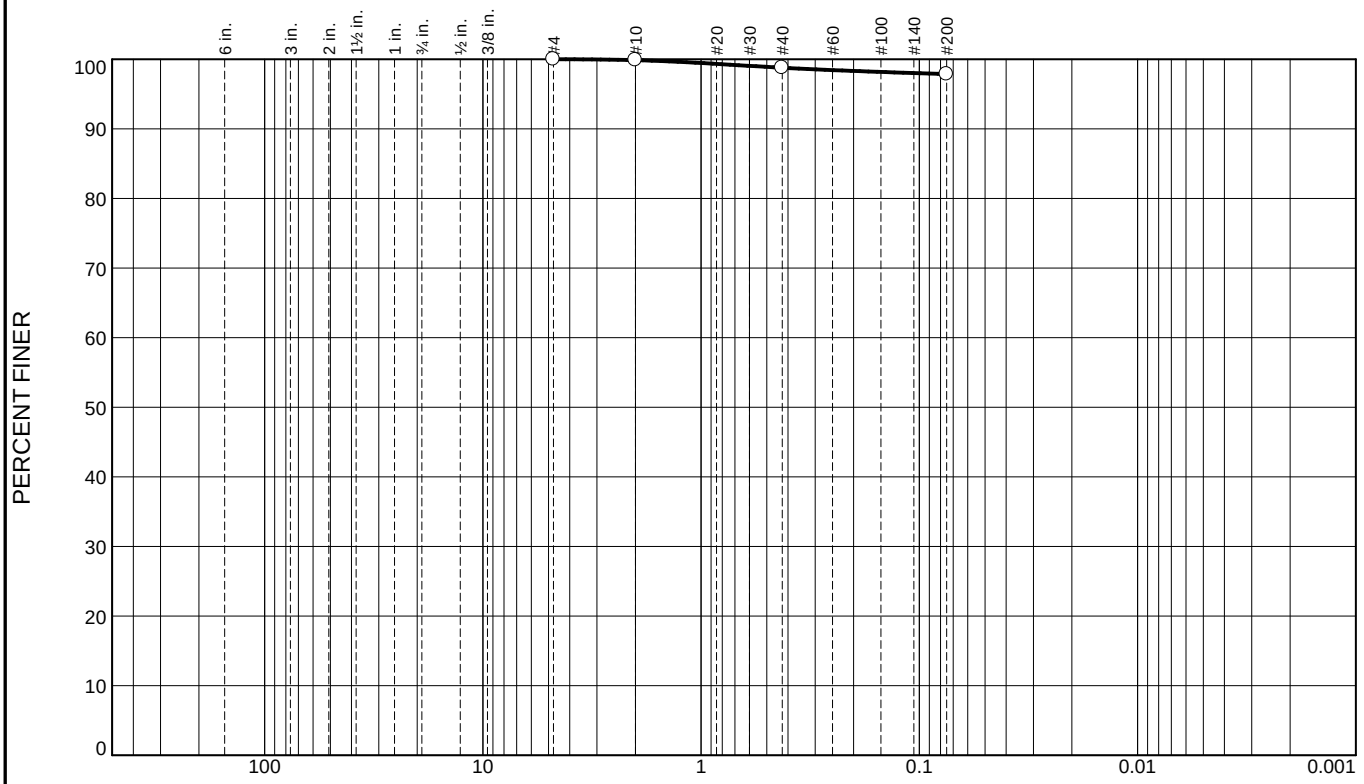
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.1	0.9	97.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#40	98.8		
#200	97.9		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 21 LL= 42 PI= 21

Classification

USCS= CL AASHTO= A-7-6(22)

Remarks

Source of Sample: B-20 **Depth:** 2

Date:

Materials Testing of Arkansas

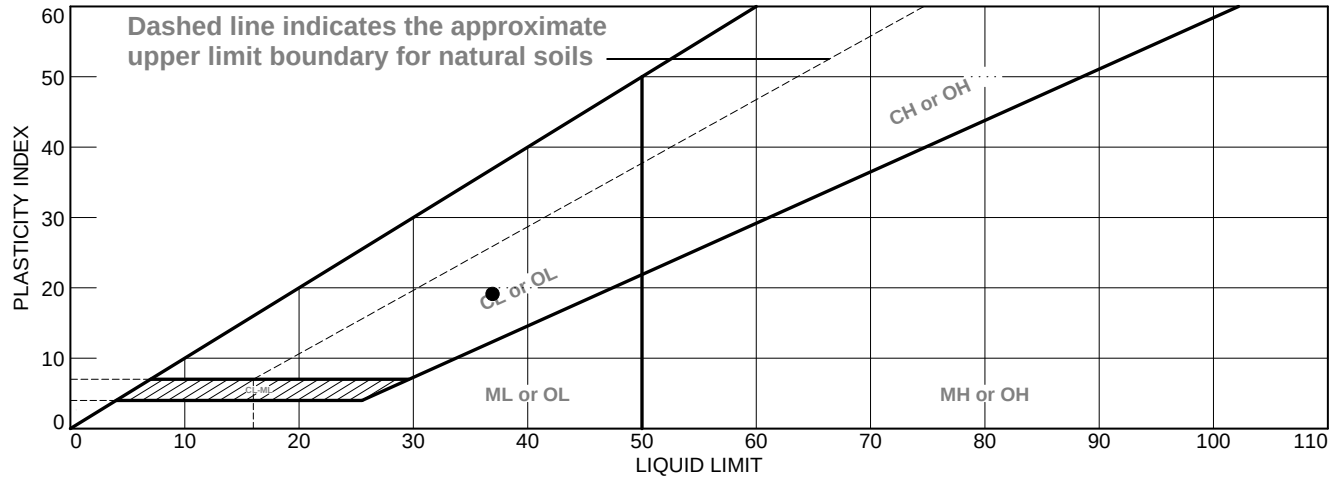
Little Rock, AR

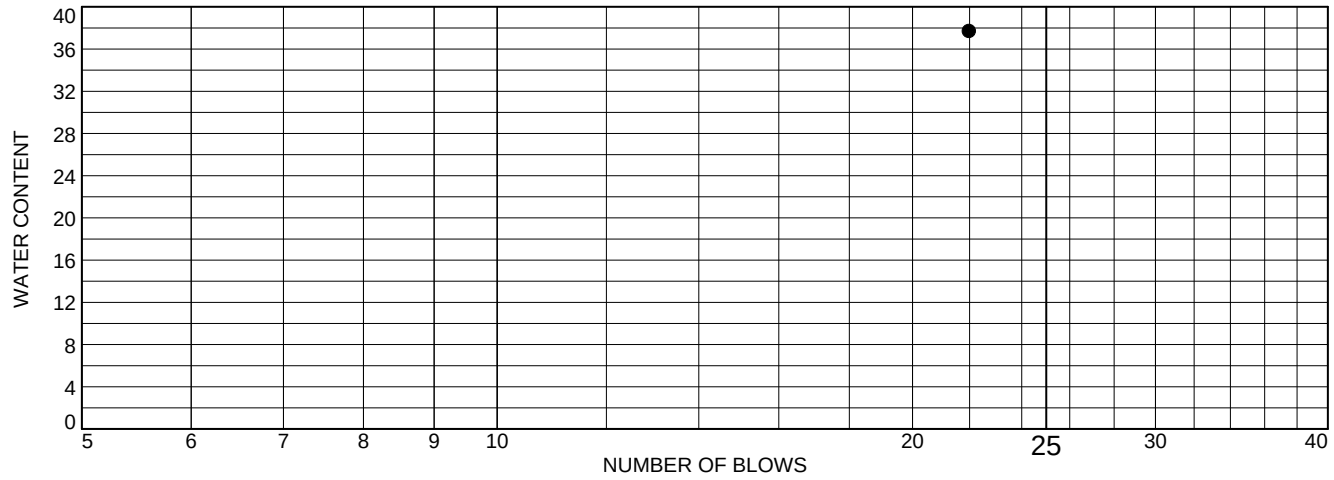
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	37	18	19	99.4	98.3	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** B-21 **Depth:** 6

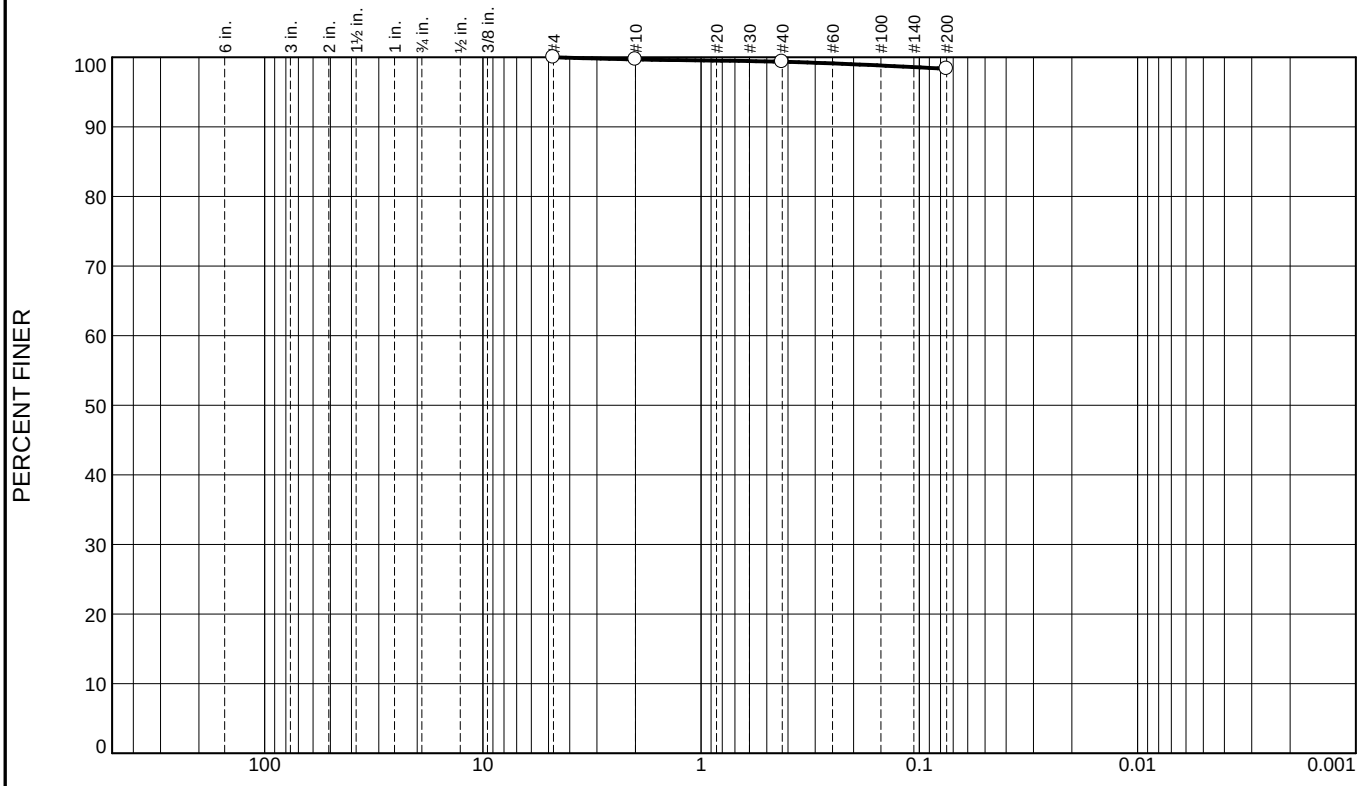
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	0.3	1.1	98.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#40	99.4		
#200	98.3		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 18 LL= 37 PI= 19

Classification

USCS= CL AASHTO= A-6(19)

Remarks

Source of Sample: B-21 **Depth:** 6

Date:

Materials Testing of Arkansas

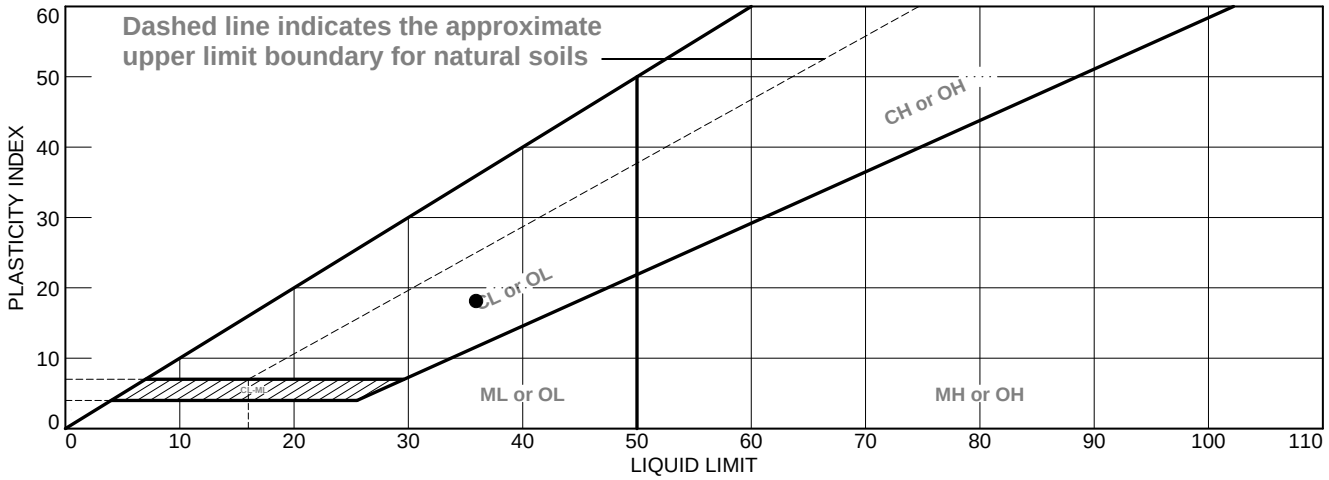
Little Rock, AR

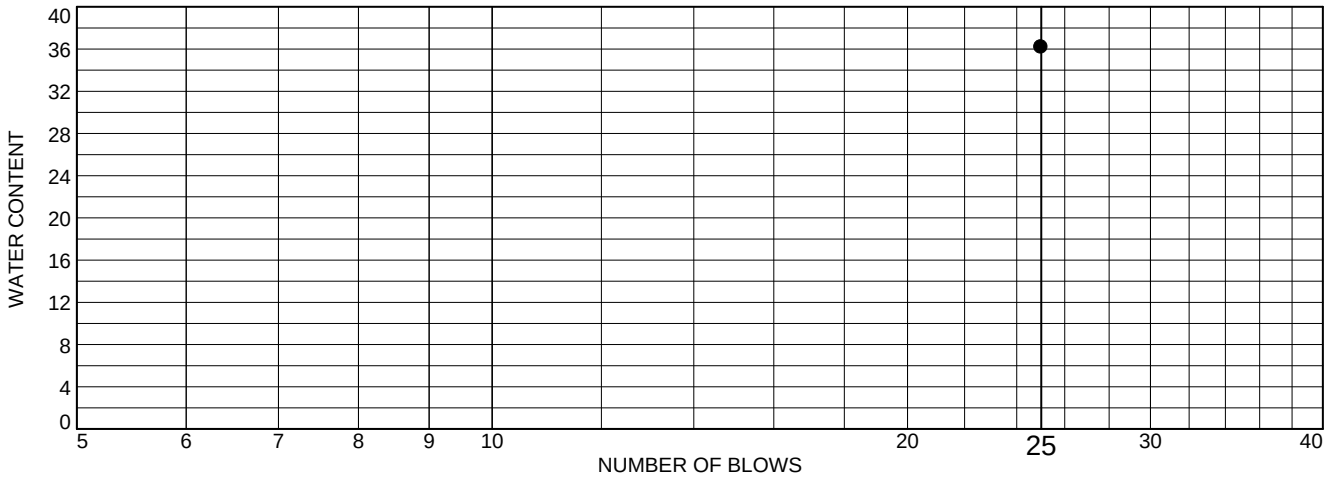
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY W/ TRACE FINE SAND	36	18	18	91.9	85.7	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** P-7 **Depth:** 0

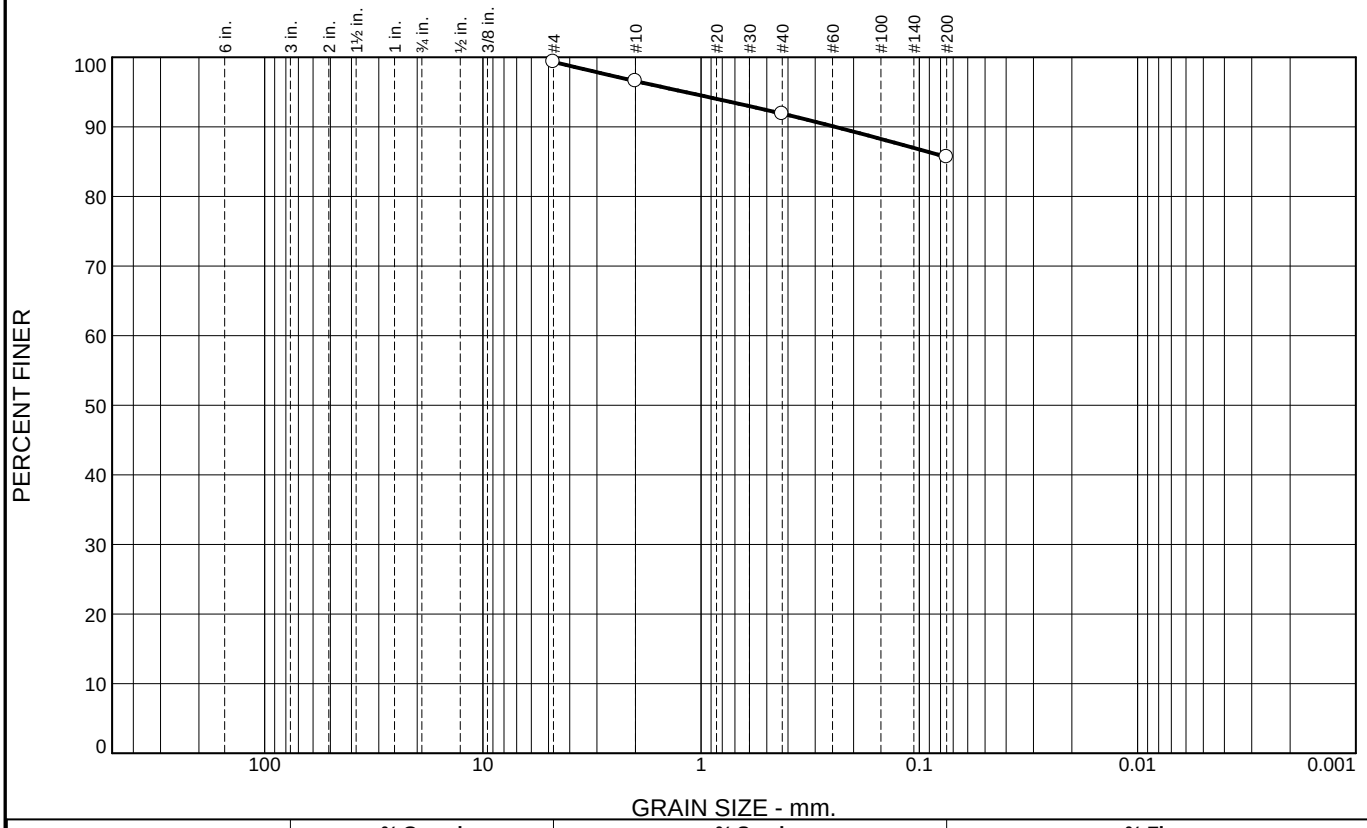
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			2.7	4.7	6.2	85.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.3		
#10	96.6		
#40	91.9		
#200	85.7		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY W/ TRACE FINE SAND

Atterberg Limits

PL= 18 LL= 36 PI= 18

Classification

USCS= CL AASHTO= A-6(15)

Remarks

Source of Sample: P-7 **Depth:** 0

Date:

Materials Testing of Arkansas

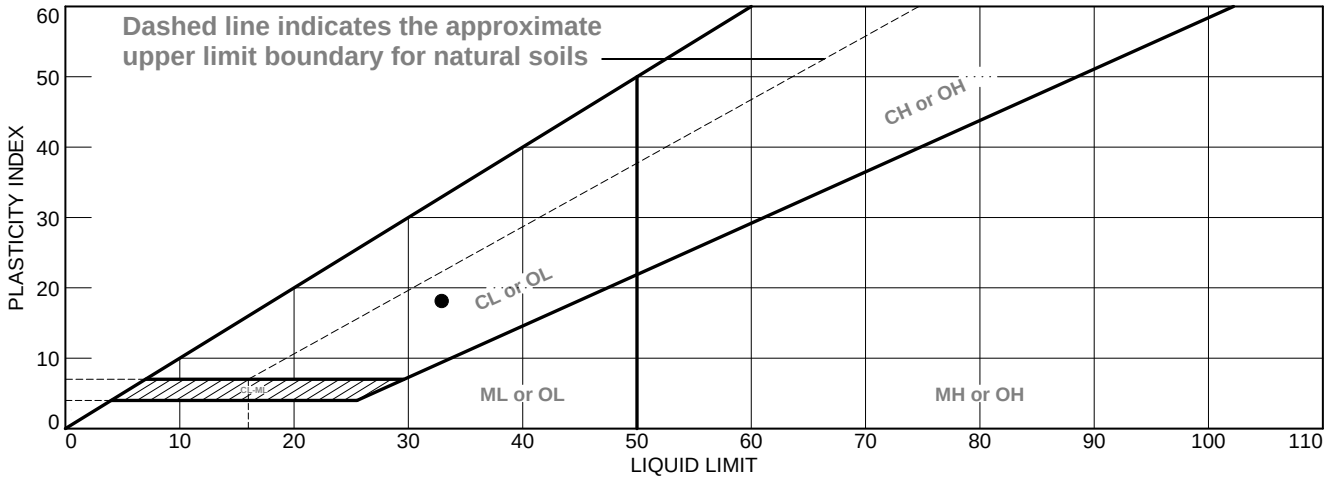
Little Rock, AR

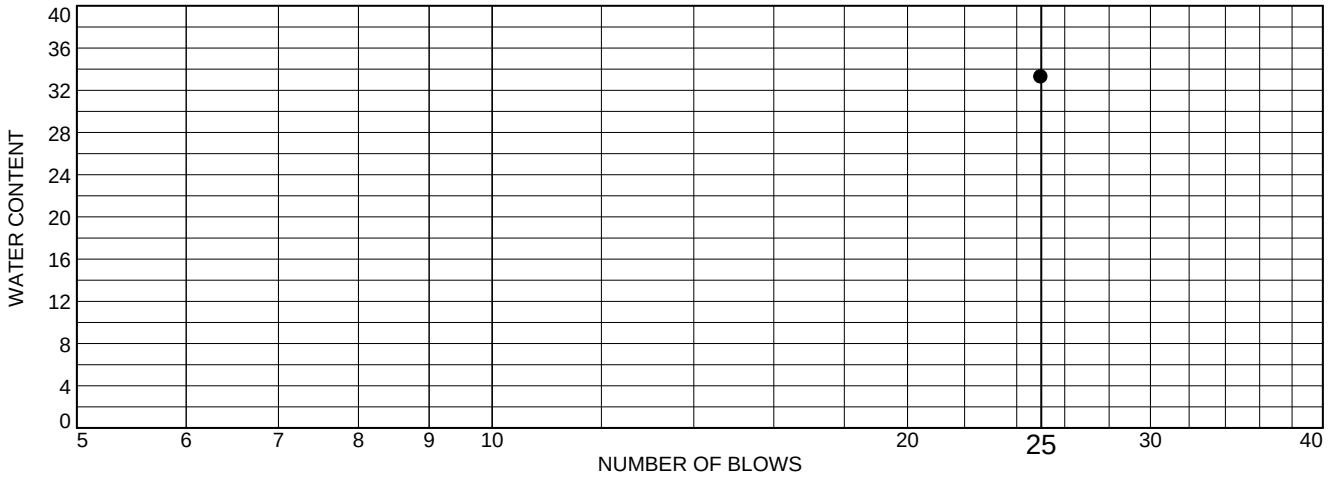
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	33	15	18	92.9	90.3	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** P-10 **Depth:** 0

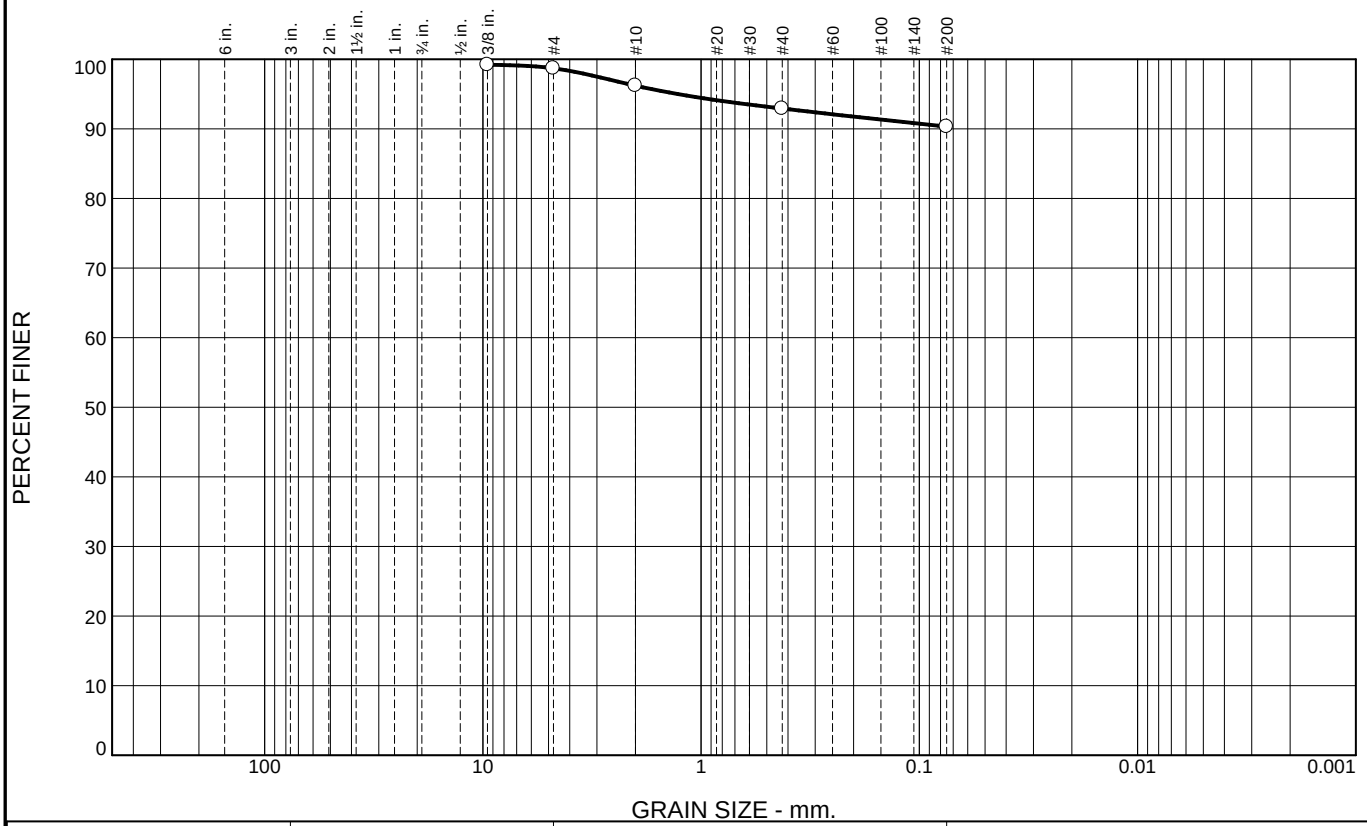
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			2.5	3.3	2.6	90.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	99.2		
#4	98.7		
#10	96.2		
#40	92.9		
#200	90.3		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 15 LL= 33 PI= 18

Classification

USCS= CL AASHTO= A-6(15)

Remarks

Source of Sample: P-10 **Depth:** 0

Date:

Materials Testing of Arkansas

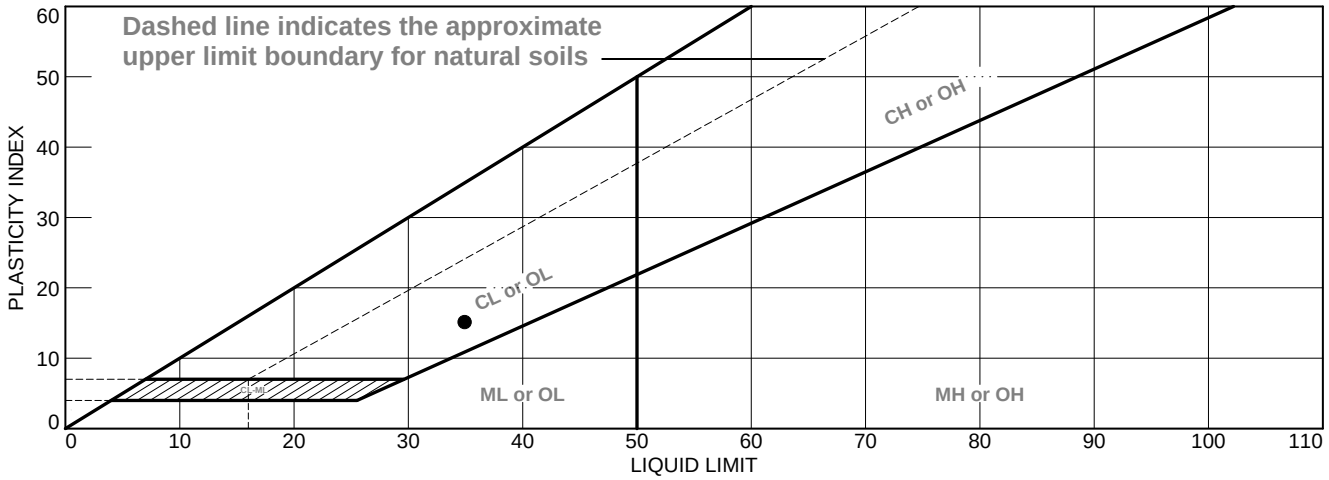
Little Rock, AR

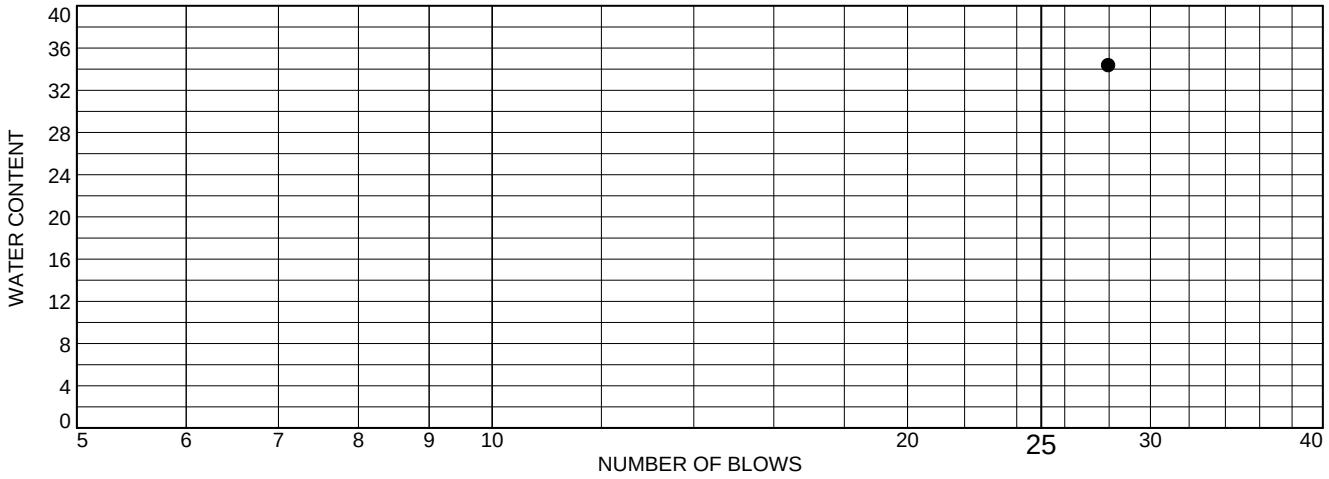
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, SANDY LEAN CLAY	35	20	15	92.9	67.1	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** P-12 **Depth:** 0

Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			2.0	4.5	25.8	67.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.4		
#10	97.4		
#40	92.9		
#200	67.1		

* (no specification provided)

Material Description

TAN-GRAY, SANDY LEAN CLAY

Atterberg Limits

PL= 20 LL= 35 PI= 15

Classification

USCS= CL AASHTO= A-6(8)

Remarks

Source of Sample: P-12 **Depth:** 0

Date:

Materials Testing of Arkansas

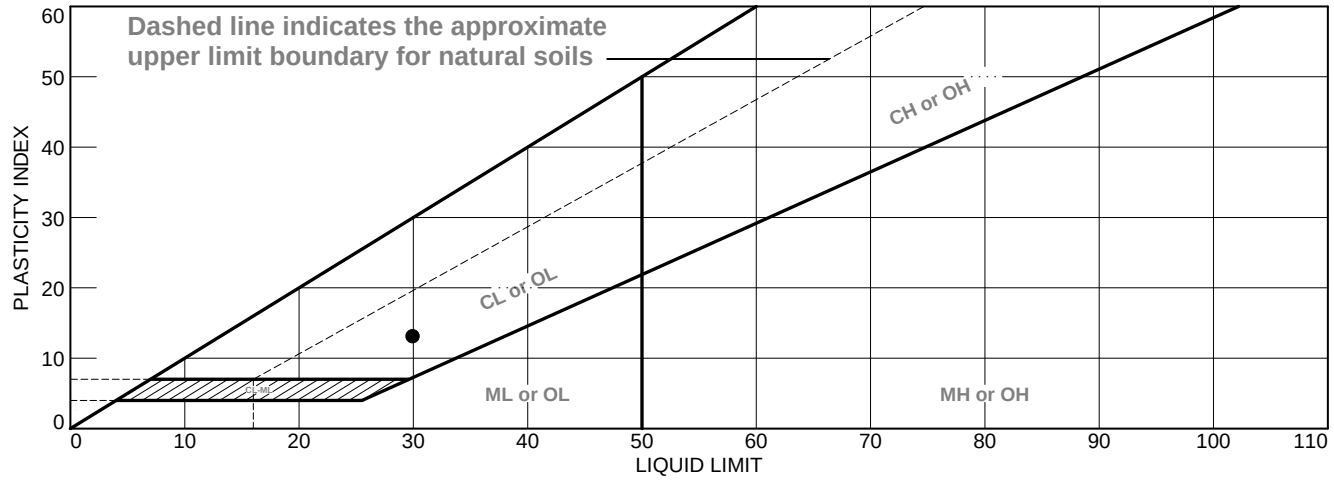
Little Rock, AR

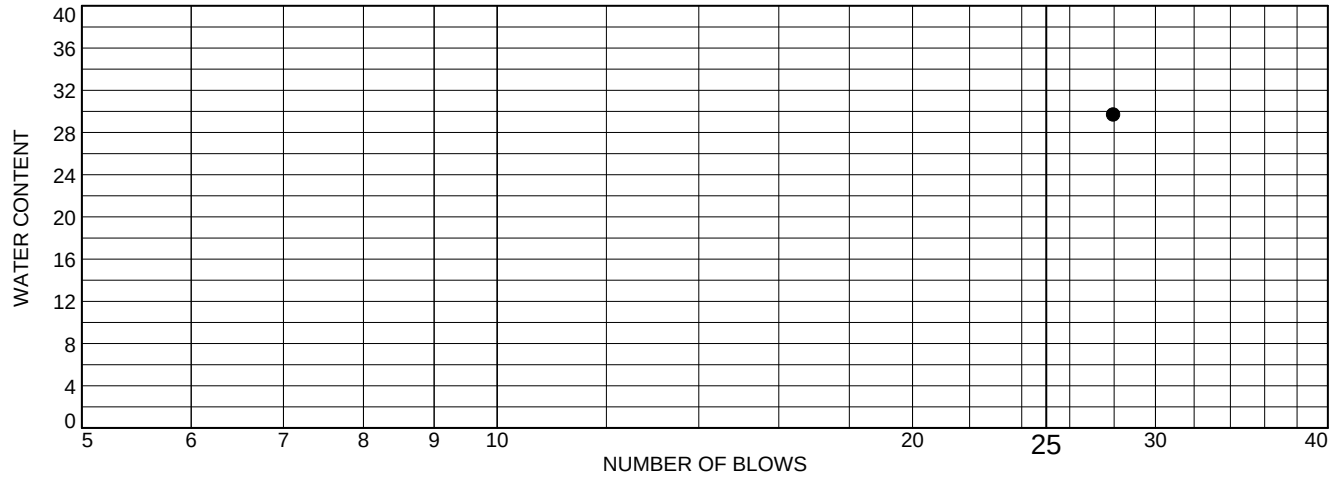
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	30	17	13	96.7	95.3	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** P-14 **Depth:** 0

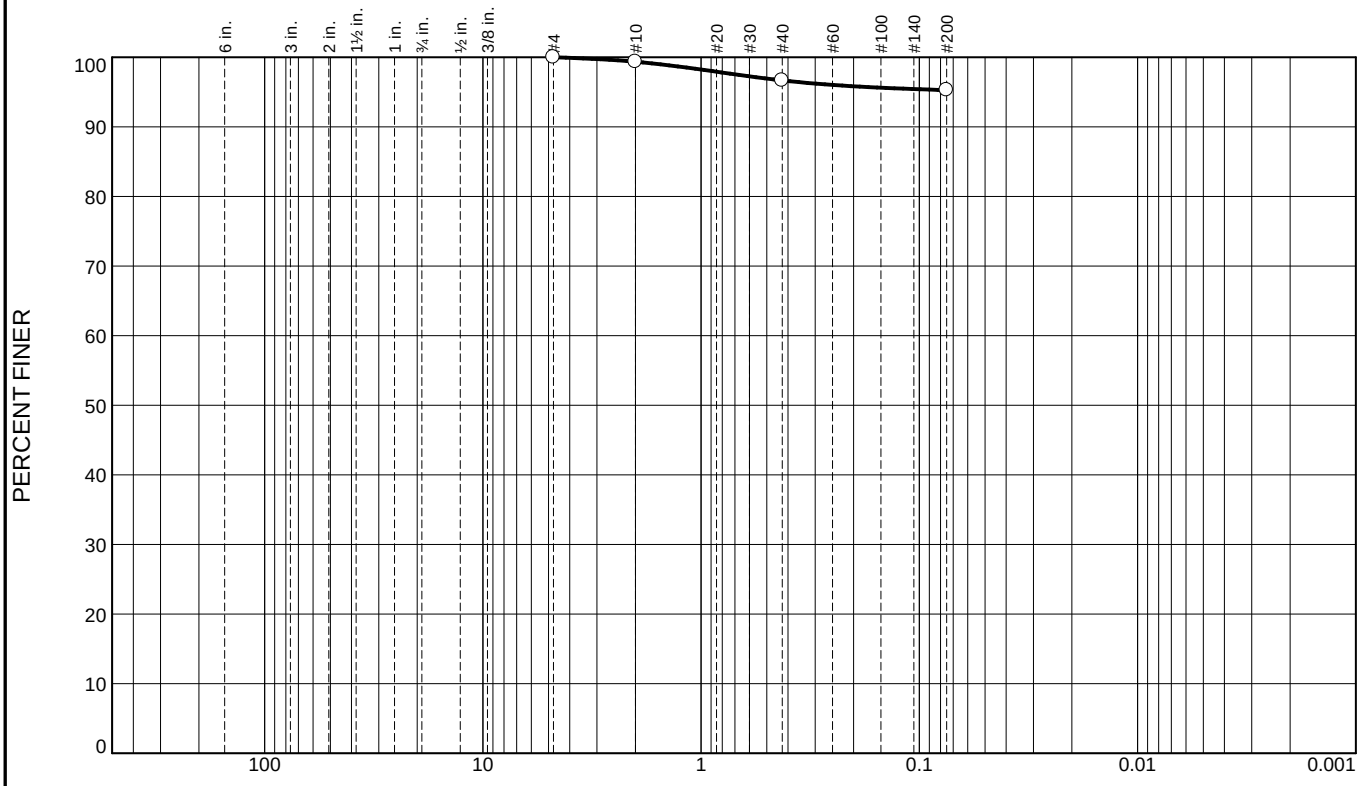
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	2.7	1.4	95.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#40	96.7		
#200	95.3		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 17 LL= 30 PI= 13

Classification

USCS= CL AASHTO= A-6(11)

Remarks

Source of Sample: P-14 **Depth:** 0

Date:

Materials Testing of Arkansas

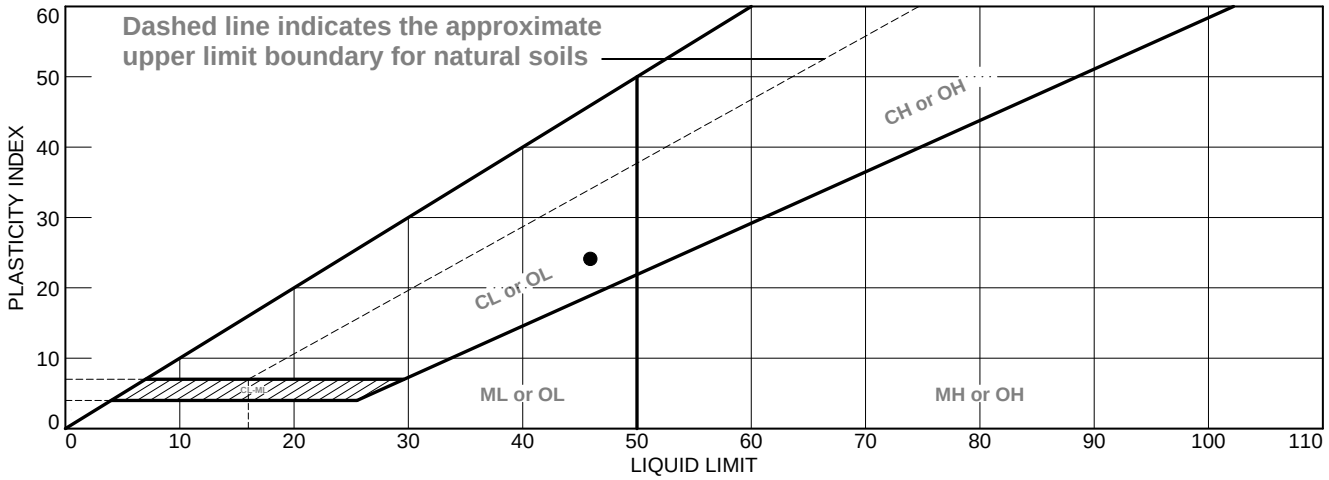
Little Rock, AR

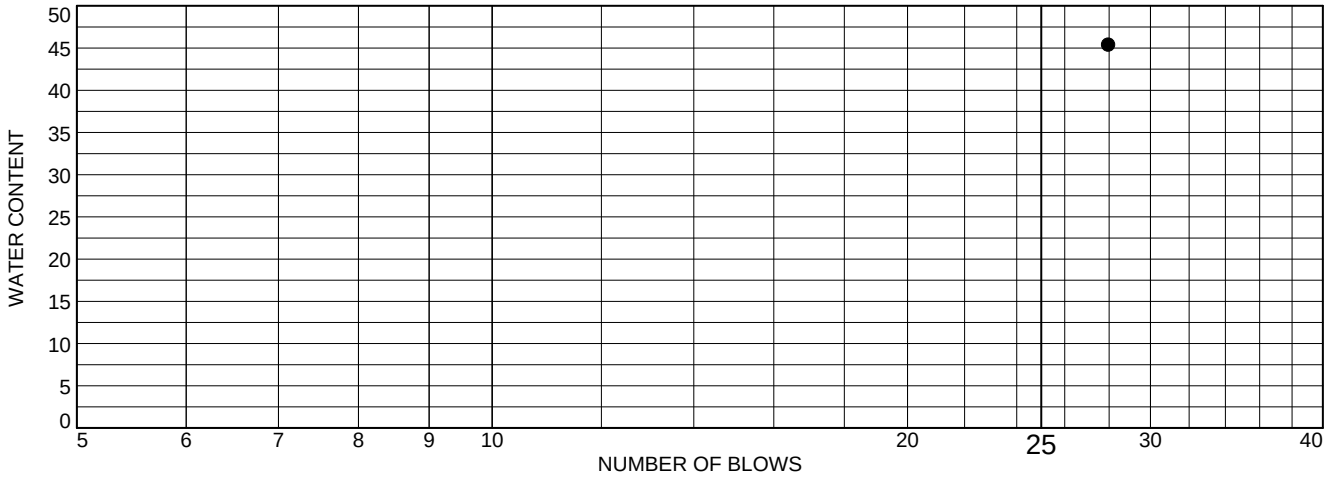
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	46	22	24	94.7	92.4	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** P-16 **Depth:** 0

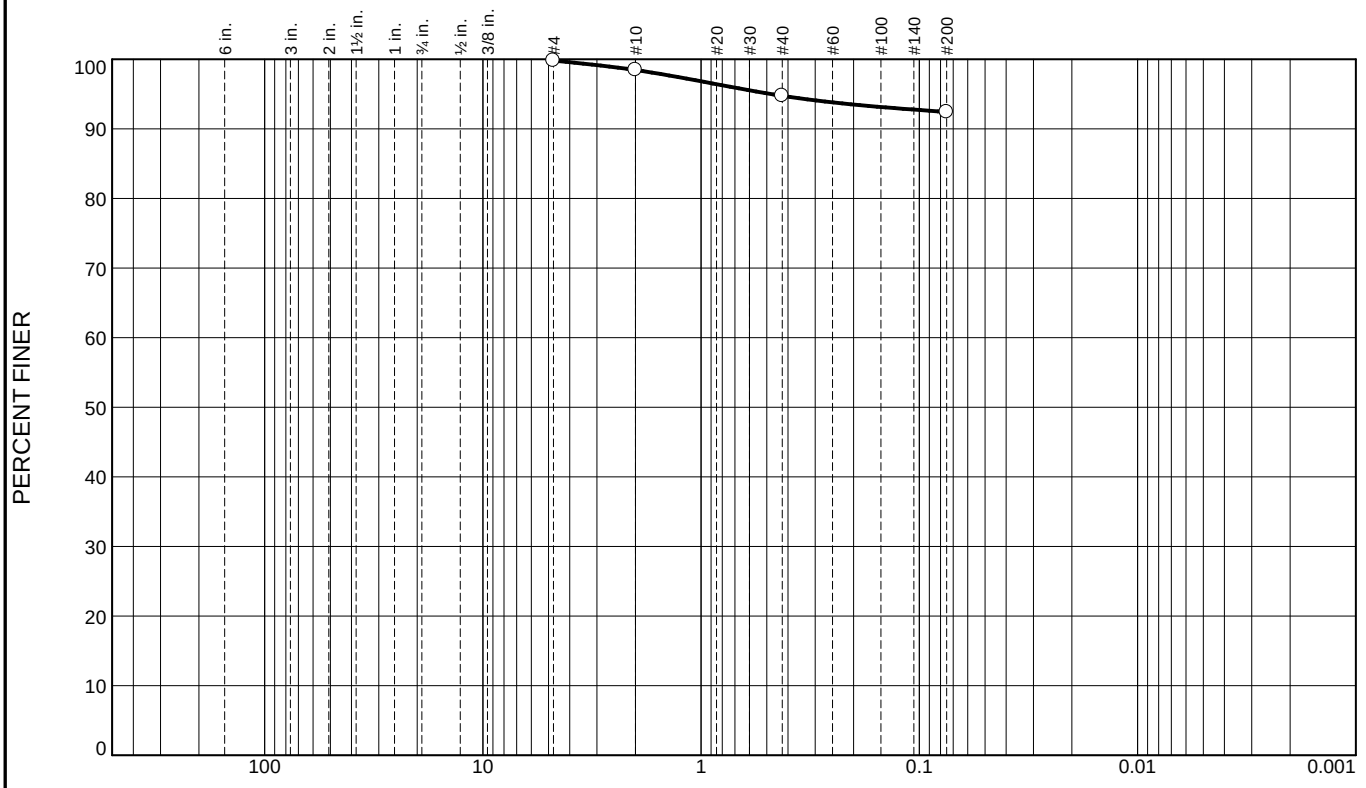
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			1.3	3.8	2.3	92.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.8		
#10	98.5		
#40	94.7		
#200	92.4		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 22 LL= 46 PI= 24

Classification

USCS= CL AASHTO= A-7-6(24)

Remarks

Source of Sample: P-16 **Depth:** 0

Date:

Materials Testing of Arkansas

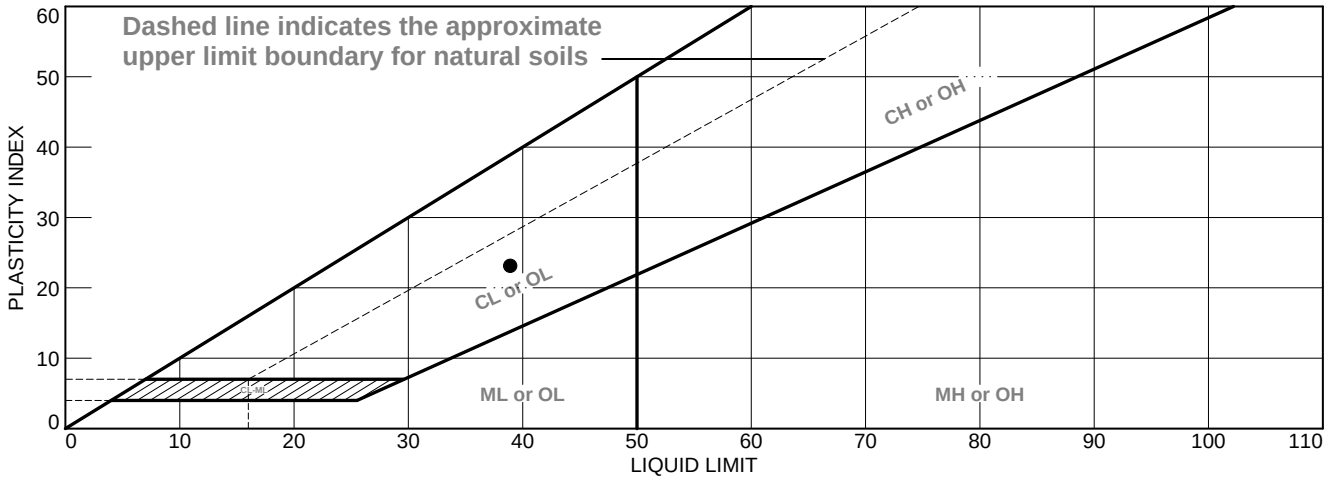
Little Rock, AR

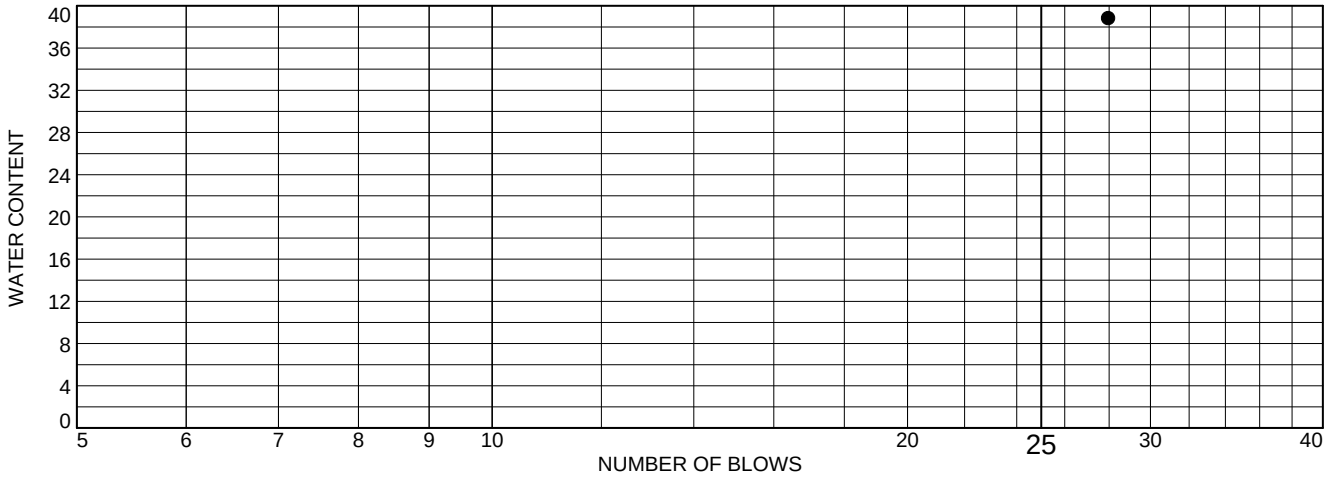
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	39	16	23		93.8	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** S-1 **Depth:** 2

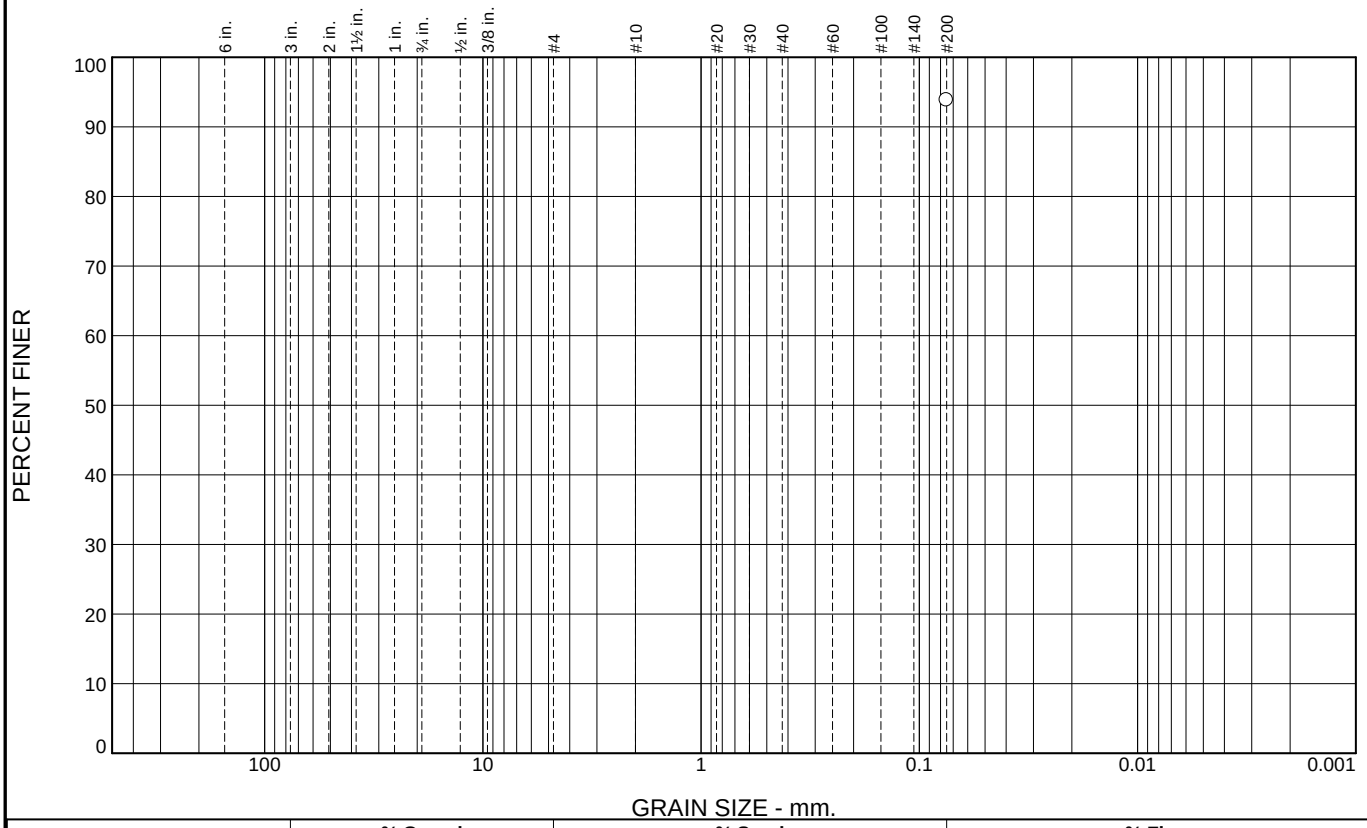
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						93.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	93.8		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 16 LL= 39 PI= 23

Classification

USCS= CL AASHTO=

Remarks

Source of Sample: S-1 **Depth:** 2

Date:

Materials Testing of Arkansas

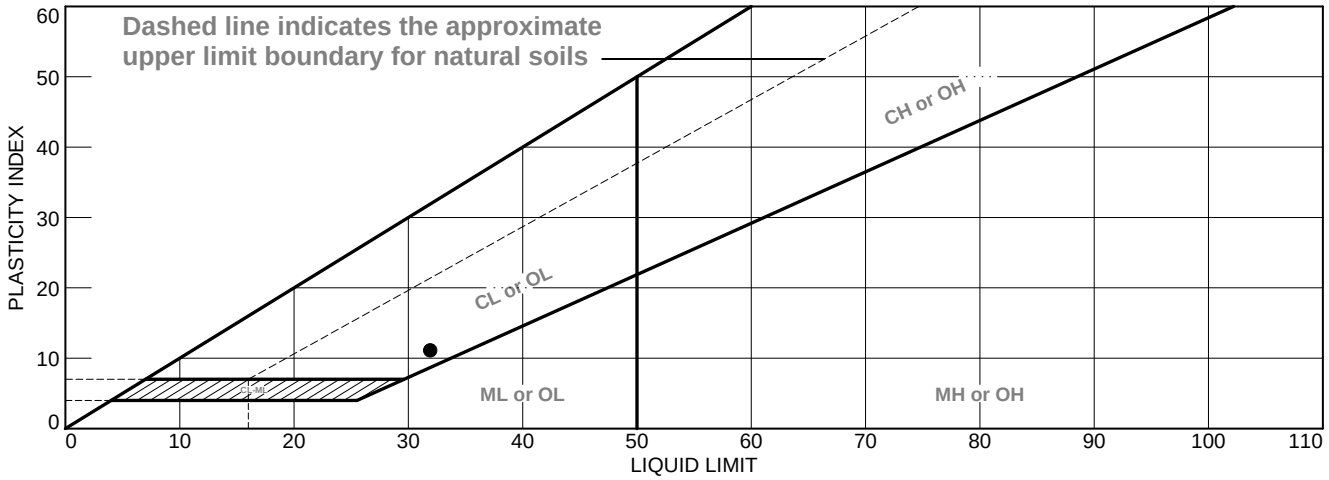
Little Rock, AR

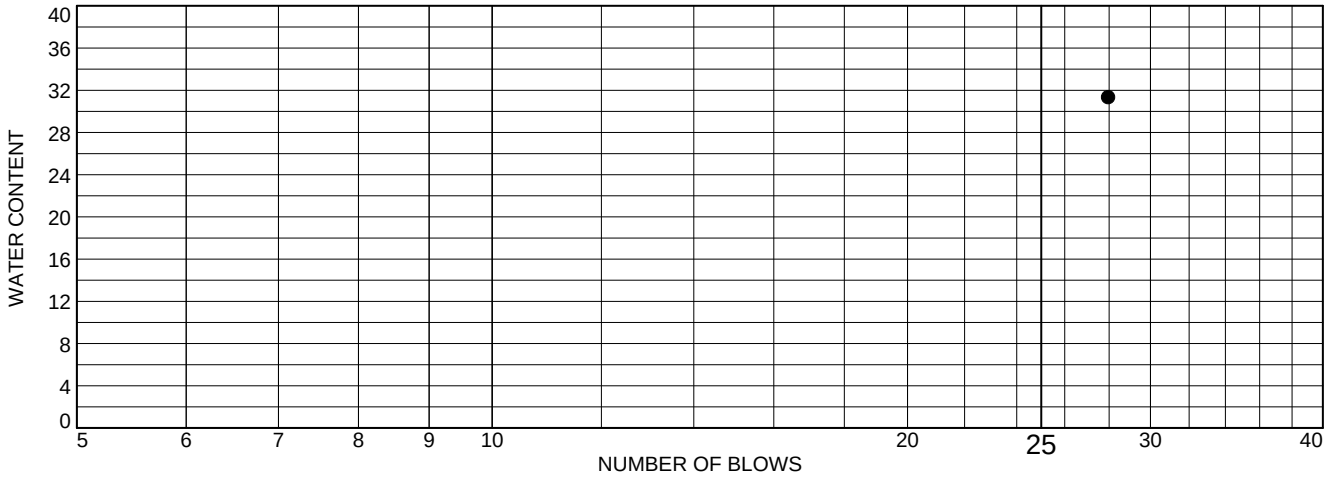
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	32	21	11	98.2	97.4	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** S-3 **Depth:** 4

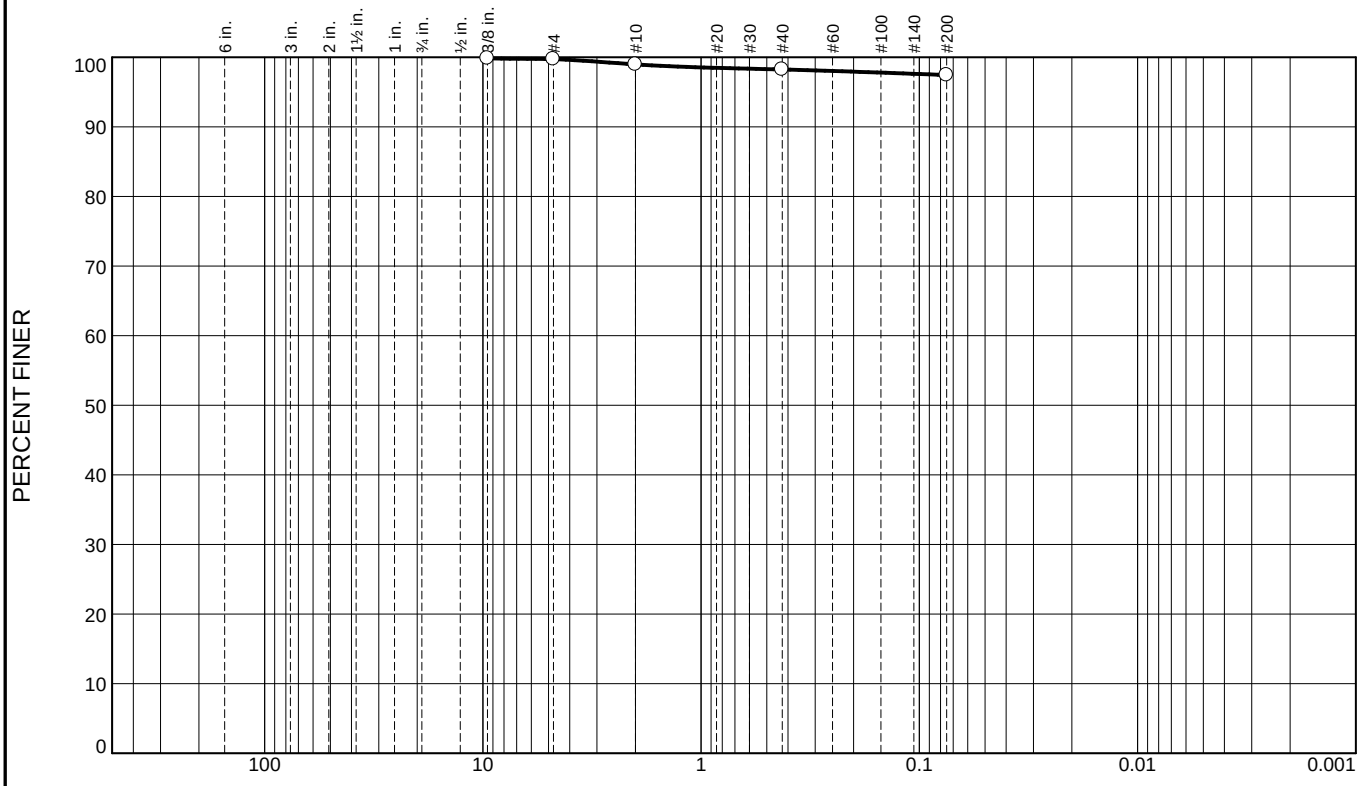
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			0.7	0.8	0.8	97.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	99.8		
#4	99.7		
#10	99.0		
#40	98.2		
#200	97.4		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 21 LL= 32 PI= 11

Classification

USCS= CL AASHTO= A-6(11)

Remarks

Source of Sample: S-3 **Depth:** 4

Date:

Materials Testing of Arkansas

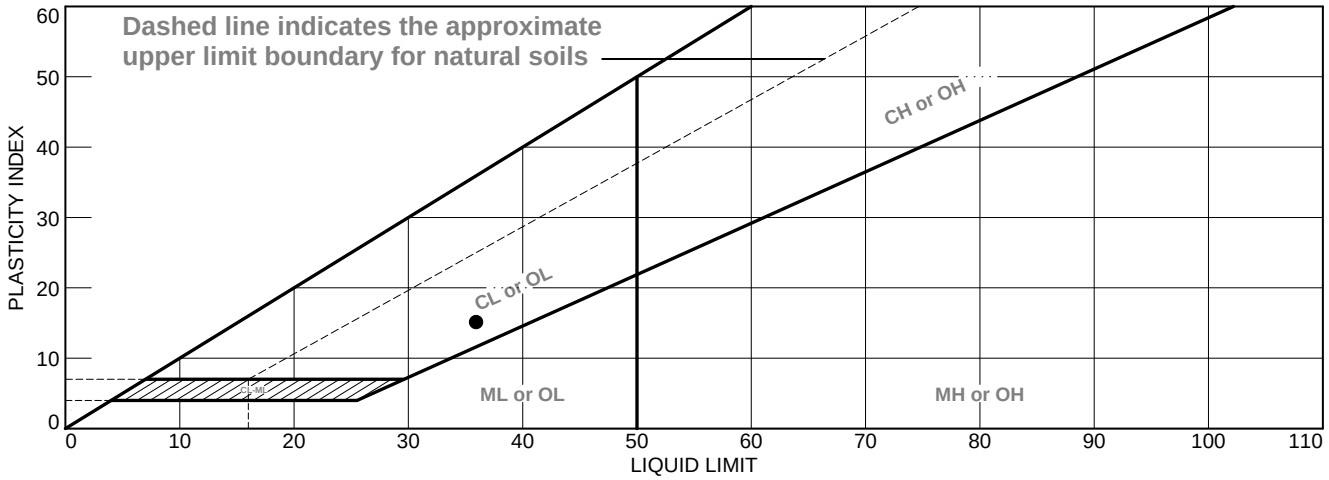
Little Rock, AR

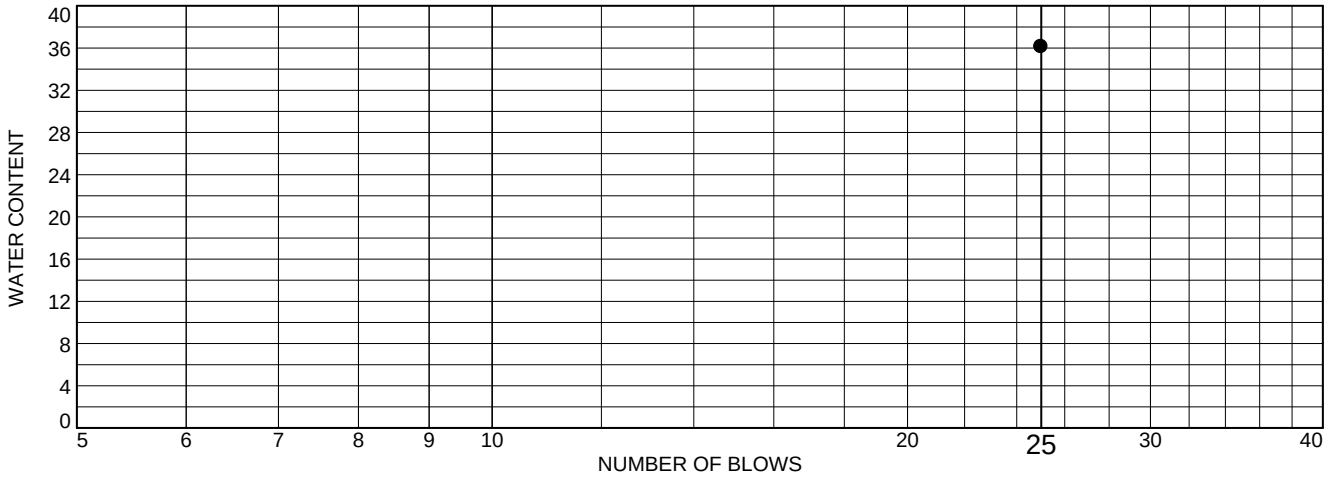
Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	TAN-GRAY, LEAN CLAY	36	21	15	95.7	94.1	CL

Project No. GEO24-100 **Client:** WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

●**Source of Sample:** S-6 **Depth:** 2

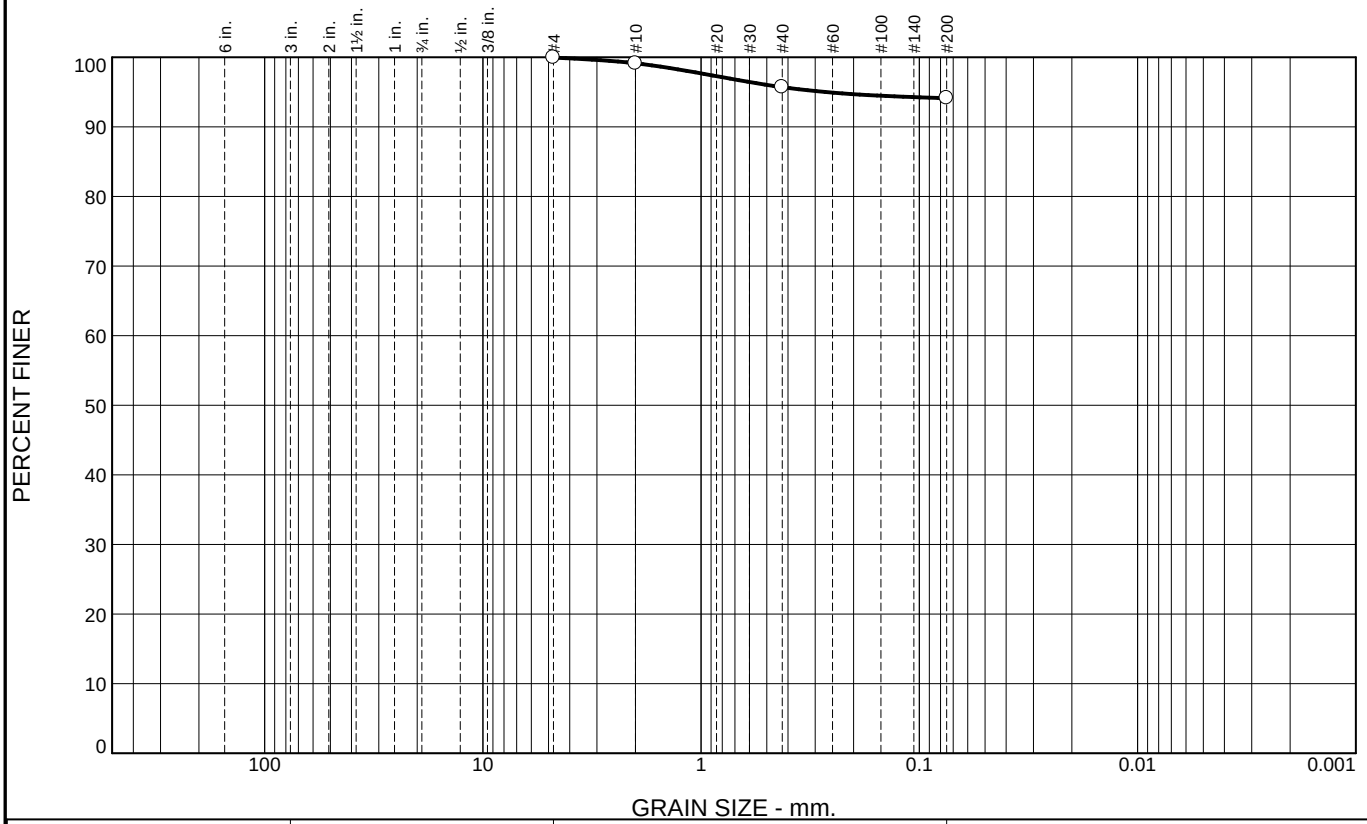
Remarks:

Materials Testing of Arkansas

Little Rock, AR

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			0.8	3.4	1.6	94.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	99.9		
#10	99.1		
#40	95.7		
#200	94.1		

* (no specification provided)

Material Description

TAN-GRAY, LEAN CLAY

Atterberg Limits

PL= 21 LL= 36 PI= 15

Classification

USCS= CL AASHTO= A-6(15)

Remarks

Source of Sample: S-6 **Depth:** 2

Date:

Materials Testing of Arkansas

Little Rock, AR

Client: WDD ARCHITECTS

Project: CRAIGHEAD ELECTRIC AADITION

Project No: GEO24-100 **Figure**

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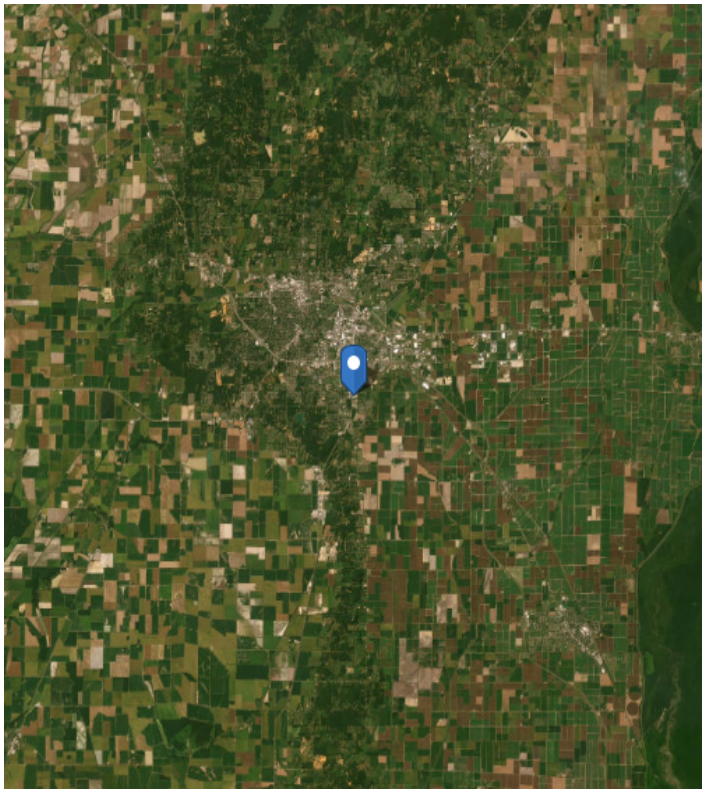
Appendix E:
Seismic Design Criteria

ASCE Hazards Report

Address:
4314 S Stadium Blvd
Jonesboro, Arkansas
72404

Standard:	ASCE/SEI 7-22	**Latitude:**	35.78959
Risk Category:	II	**Longitude:**	-90.668869
Soil Class:	D - Stiff Soil	**Elevation:**	258.07947198557696 ft (NAVD 88)



Seismic

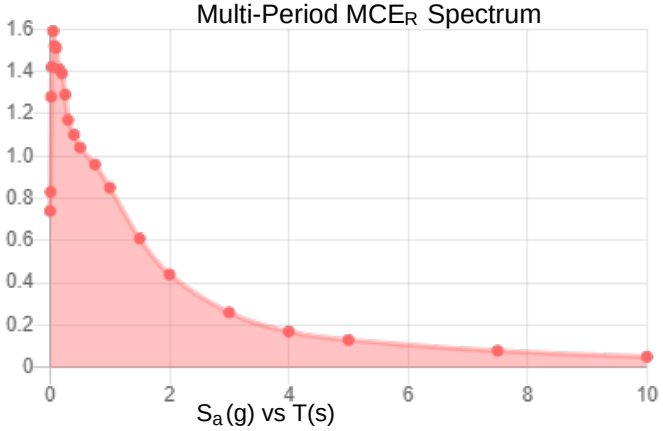
Site Soil Class: D - Stiff Soil

Results:

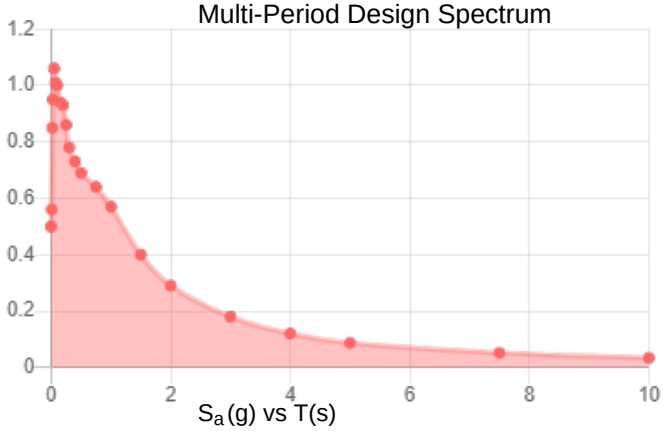
PGA_M :	0.7	T_L :	12
S_{MS} :	1.25	S_S :	1.57
S_{M1} :	0.85	S_1 :	0.42
S_{DS} :	0.83	V_{S30} :	260
S_{D1} :	0.57		

Seismic Design Category: D

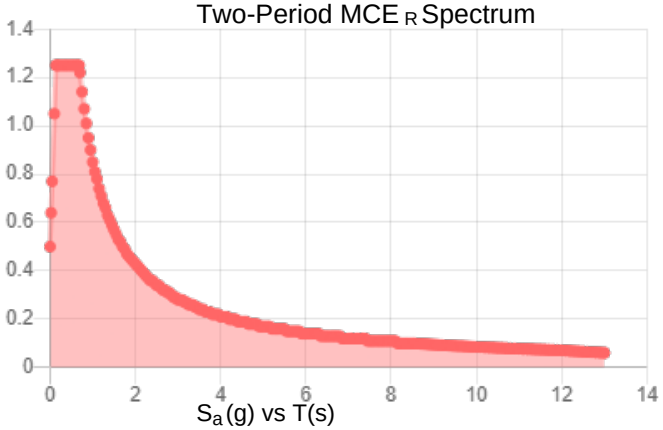
Multi-Period MCE_R Spectrum



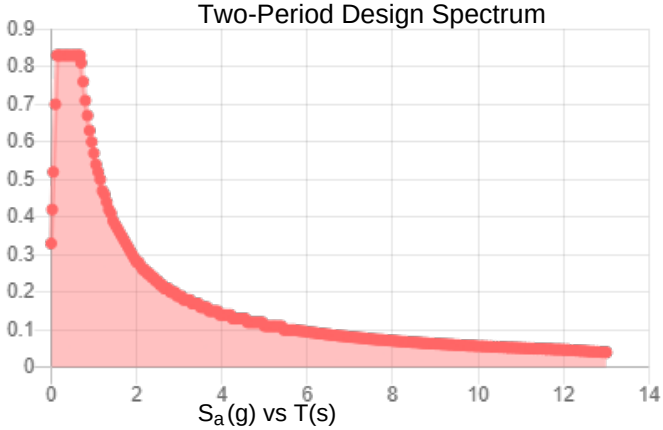
Multi-Period Design Spectrum



Two-Period MCE_R Spectrum



Two-Period Design Spectrum



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Data Accessed:

Date Source:
USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

Flood

Results:

Flood Zone Categorization:	Some areas are not in the National Flood Hazard Layer. Consult the Authority Having Jurisdiction.
Base Flood Elevation:	Refer to map for local elevations and interpolate according to the Authority Having Jurisdiction.
Data Source:	FEMA National Flood Hazard Layer - Effective Flood Hazard Layer for US, where modernized (https://msc.fema.gov/portal/search)
Date Accessed:	Fri Jul 19 2024
FIRM Panel:	If available, download FIRM panel here
Insurance Study Note:	Download FEMA Flood Insurance Study for this area here

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE Hazard Tool.

CRAIGHEAD ELECTRIC COOPERATIVE CORPORATION
NEW MAINTENANCE SHOP ADDITION
Bid Date: March 11, 2025
Bid Time: 2:00 PM
Jonesboro, Arkansas
WDD Project No.: 24-096

Proposal of _____
(Hereinafter called "Bidder"): (Strike Out Following Inapplicable Items)

1. An _____ Corporation,
   (State)
2. A Partnership, or

3. An Individual doing business as _____

To: **Craighead Electric Cooperative Corporation**

Gentlemen: Bidder, in compliance with bid solicitation for a **New Maintenance Shop Addition, Jonesboro, Arkansas**, having examined plans and specifications with related documents and site of the proposed Work, and being familiar with all conditions surrounding proposed project, including availability of materials and labor, hereby proposes to furnish labor, materials, and supplies, and construct project in accordance with Contract Documents, within time set forth therein, and at prices stated below. Prices are to cover all expenses incurred in performing Work required under Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on date specified in written "Notice to Proceed" and fully complete project within _____ consecutive calendar days.

Bidder acknowledges receipt of the following addenda:

No._____ Date:_____ No._____ Date:_____ No._____ Date:_____

No._____ Date:_____ No._____ Date:_____ No._____ Date:_____

BASE BID: Bidder agrees to perform all Work described in the Project Manual and shown on the

Drawings for the sum of _____

_____Dollars ($_____).

LIST OF UNIT PRICES

The Bidder shall **include in the Base Bid** the following lump sum allowances computed based upon the quantities listed and unit costs indicated. Unit prices include all Contractor cost including labor, material, General Conditions and overhead and profit. Bidder understands that the Owner reserves the right to review and or negotiate Unit Prices that are deemed to be not in accordance with current market value of proposed services.

In the event the actual quantities are greater or less than the given volumes, the unit prices stated will be used to adjust the contract accordingly.

1. **Unit Price No. 1:** Undercut and related replacement fill.

   Unit Price per Cubic Yard: $ _____ per CY

2. **Unit Price No. 2:** For importing, placing and compacting select fill material at undercut areas only. This is in addition to the fill material required to establish grades shown on the drawings which is to be included in the Base Bid.

   Unit Price per Cubic Yard: $ _____ per CY

LIST OF SUBCONTRACTORS

I, the undersigned General Contractor, certify that proposals from the following subcontractors were used in the preparation of my proposal. I agree that if I am the successful bidder, and if following subcontractors are approved, I will not enter into contracts with others for these divisions of the Work without written approval from Architect and Owner.

NAME: LICENSE NO.

MECHANICAL: _____

PLUMBING: _____

ELECTRICAL: _____

ROOFING AND SHEET METAL: _____

PRE-ENGINEERED STRUCTURE: _____

Bidder understands that Owner reserves right to reject any or all bids and to waive any formalities in the bidding. Bidder agrees bid shall be good and may not be withdrawn for period of sixty (60) days after scheduled closing time for receiving bids.

Upon receipt of written notice of acceptance of bid, Bidder will execute formal contract within ten (10) days and deliver Surety Bond or Bonds as required by Document 00 61 13.

Bid security attached in amount of 5% of base bid is to become property of Owner in event above contract and bond are not executed within time set forth above as liquidated damages and additional expenses to Owner.

By:_____ Date:_____

(Typed Name)

_____ Contractor License No._____

(Signature)

_____

(Title)

_____

(Business Address)

_____

(Seal - If bid is by a Corporation)

END OF DOCUMENT 00 41 13

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PART 1 - GENERAL

1.01 AUTHORITY

A. The Agreement Form and Exhibit A, Insurance and Bonds, are an integral part of all sections of Project Manual. Their contents and provisions shall be carefully noted in performance of Work. Include this Agreement Form and Exhibit A in the bid documents for all building construction and renovation projects.

B. The Agreement Form is the legal instrument which is typically signed by an owner and a contractor subsequent to contract award. A legally binding contract is actually created when accepted, without qualification, the Contractor's bid. However it is this Agreement Form, which when subsequently signed by the parties, formalizes the Contract and confirms the Contractor's intention to be bound by its provisions.

1.02 GOVERNING STANDARD DOCUMENT

A. "Standard Form of Agreement Between Owner and Contractor", AIA Document A101 - 2017 of American Institute of Architects, 2017 Edition, Articles 1 through 9 inclusive, and AIA Document A101 - 2017 Exhibit A is hereby referenced and incorporated into these specifications and is to be used as the General Conditions for this contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT 00 52 13

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PART 1 - GENERAL

1.01 CONTRACTOR'S GUARANTY BOND

A. Contractor shall furnish "Performance and Payment Bond" in amount equal to 100% of contract price, as security for faithful performance of this contract and for payment of all indebtedness for labor and materials furnished or performed in connection with this contract. Bond shall be written by surety company which has qualified and is authorized to do business in the State of Arkansas and must be executed by a resident or nonresident agent who is licensed by the Insurance Commissioner to represent surety company executing said bond and filing with said bond, his power of attorney as his authority. Mere countersigning of a bond will not be sufficient. Bond shall be written in favor of Owner, and executed pursuant to terms of Arkansas Code Annotated §18-44-501 et seq., §18-44-503 et seq., §19-4-1401 et seq., and §22-9-401 et seq. The Surety guarantees that the Principal shall comply with Ark. Code Ann. §22-9-301 et seq. by payment and full compliance with all prevailing hourly wage contract provisions where the contract amount exceeds the amount provided by law. An original and two copies of bond must be furnished, with power of attorney attached to each. Bond must not be dated prior to date of the contract. Contractor shall file (not record) the original with the Clerk in the Circuit Court of the County in which Work to be performed is located. Contractor to pay all expenses incident the filing of bond. Remaining two copies should be certified by the Clerk to evidence filing of original, and these two copies submitted to Architect.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT 00 61 13

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PART 1 - GENERAL

1.01 AUTHORITY

A. General Conditions and Supplementary Conditions are an integral part of all sections of Project Manual. Their contents and provisions shall be carefully noted in performance of Work.

1.02 GOVERNING STANDARD DOCUMENT

A. American Institute of Architects AIA Document A201 - 2017 Edition, General Conditions of the Contract for Construction, Articles 1 through 15 inclusive, is hereby referenced and incorporated into these specifications and is to be used as the General Conditions for this contract.

1.03 AMENDED PROVISIONS

A. Where any article or articles of above AIA General Conditions are supplemented by Supplementary Conditions, provisions of such articles shall remain in effect and supplementary provisions shall be considered as added thereto. Where any such article or part of such article is amended, voided or changed by Supplementary Conditions, provisions not specifically so amended, voided or changed shall remain in full effect. Where provisions of Supplementary Conditions are at variance or conflict with provisions of the AIA General Conditions, Supplementary Conditions shall govern. AIA General Conditions and Supplementary Conditions apply to all Work in every Division or Section of these Specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT 00 72 13

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PART 1 - GENERAL

1.01 REFERENCE DOCUMENT

A. These Supplementary Conditions are included as a part of the contract documents for this project to amend the provisions of the "General Conditions of the Contract for Construction", Document A201 of the American Institute of Architects, 2017 Edition, as required for this project. Reference herein to articles of the General Conditions refer to said Document A201.

1.02 PARAGRAPH 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

A. Add subparagraph 3.3.4 as follows:

"3.3.4 Contractor (1) shall review any specified construction or installation procedure (including those recommended by manufacturers); (2) shall advise the Architect (a) if the specified procedure deviates from good construction practice, (b) if following the procedure will affect any warranties, including the Contractor's general warranty, or (c) of any objections the contractor may have to the procedure; and (3) to propose any alternative procedure which the Contractor will warrant."

1.03 PARAGRAPH 3.4 LABOR AND MATERIALS

A. Add Subparagraphs 3.4.4 as follows:

"3.4.4 All contractors and subcontractors engaged in the Owner/Contractor Agreement shall conform to the labor laws of the State in which Work is to be performed and the various acts amendatory and supplementary thereto; and to all other laws, ordinances and legal requirements applicable thereto."

1.04 PARAGRAPH 3.5 WARRANTY

A. Add subparagraph 3.5.3 as follows:

"3.5.3 The Contractor shall guarantee and warrant his and his subcontractor's work and materials (including the materials and work of suppliers of the Contract and his subcontractors) for a period of one year from the date of Substantial Completion. This Warranty shall be for a longer period on certain items if so designated in the Specifications. The foregoing one-year guaranty and warranty shall not in any way limit, restrict or affect the liability of the Contractor, or his subcontractors, for indemnity as provided for in this Contract, nor shall it in any way shorten the period of limitation fixed by law for the filing of any action against the Contractor for enforcement of the or breach of any provision of the contract documents. Should the Contractor elect to use any of the equipment in the building during the construction period, he shall make arrangements with

the subcontractor or supplier of the equipment for any extension of warranty of that equipment made necessary by such use. The Warranty period for such equipment to the Owner shall not be reduced by the use of equipment by the Contractor".

1.05 PARAGRAPH 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Add the following to subparagraph 3.12.5.1:

"3.12.5.1 Incomplete or poorly prepared shop drawings or other submittals will be returned to the Contractor to be revised or redrawn prior to resubmittal. The Contractor will hold the Architect and Owner harmless against claims for losses or injury caused by errors or omissions in the shop drawings or other submittals for the Work made by the Contractor, a subcontractor, any lower tier subcontractor, manufacturer, supplier or distributor."

B. Delete subparagraph 3.12.8 and substitute the following:

"3.12.8 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect of such deviations in a separate writing or by submitting a separate written request for change at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof."

1.06 PARAGRAPH 4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

A. Add sub-subparagraph 4.2.4.1 as follows:

"4.2.4.1 Any direct communications between the Owner and the Contractor; or between the Contractor or Sub-contractors and the Architect's Consulting Engineers that affect the performance or administration of the Contract shall be made or confirmed in writing, with copies to the Architect, and any such communications that represent a modification of the Contract requirements will be documented appropriately. Any communications among the Architect and Subcontractors shall be confirmed in writing to the Contractor."

1.07 PARAGRAPH 7.2 CHANGE ORDERS

A. Delete subparagraph 7.2.1 and substitute the following:

"7.2.1 All requests for changes, additions or deductions, shall be submitted in a complete itemized breakdown acceptable to the Architect.

7.2.2 Wherein unit prices are stated in the contract, submit itemized break down showing each unit price and relative quantities.

7.2.3 The contractor shall present an itemized accounting together with appropriate supporting data for the purposes of considering additions or deductions. Supporting data shall include but is not limited to the following:

.1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and worker or workmen's compensation insurance;

.2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 additional costs of supervision and field office personnel directly attributable to the change.

.6 the value of all such additions and deductions shall then be computed as set forth in Paragraph 7.2.5.

7.2.4 The burden of proof of cost rests upon the Contractor. Contractor agrees that Owner or Owner's Representative shall have the right, at reasonable times, to inspect and audit the books and records of Contractor to verify the propriety and granting of such cost.

7.2.5 Compute requests for changes be they additions or deductions as follows:

.1 For work performed by the Contractor:

Net cost of material and delivery	a
State Sales Tax	b
Net Placing cost	c
W.C. Insurance Premium and FICA Tax	d
	a+b+c+d
Overhead and Profit, shall not exceed 12% x (a+b+c+d)	e
Allowable Bond Premium	f
TOTAL COST	(a+b+c+d)+e+f

.2 Credit for work omitted shall be computed as outlined in 7.2.5.1 "a through e" except the contractor's share of overhead and profit is 7%.

.3 For work performed by Subcontractors:
Subcontractors shall compute their work as outlined in 7.2.5.1 "a through e". To the cost of that portion of the work (change) that is performed by the subcontractor, the general contractor shall add an overhead and profit change of five (5%) percent plus the allowable bond premium.

1.08 PARAGRAPH 9.3 APPLICATIONS FOR PAYMENT

A. Delete subparagraph 9.3.1 and substitute the following:

"9.3.1 The Contractor shall present to the Architect an application for payment on or before the twenty-fifth day of each calendar month. These periodical estimates for partial payment shall be submitted on forms, prepared at the Contractor's expense and conforming to AIA Document G702. An original and a requested number of copies of such estimate shall be tendered to the Architect."

1. Each application for payment shall be accompanied by a revised Construction Schedule. Failure to provide the revised Construction Schedule may cause a delay in processing payment applications. Any areas of the Construction Schedule that are delayed from the previous schedule shall be highlighted for the Architects attention and a detailed explanation of the reason for the delay shall accompany the revised schedule.

1.09 PARAGRAPH 9.6 PROGRESS PAYMENTS

A. Delete subparagraph 9.6.1 and substitute the following:

"9.6.1 Retainage: No later than the 10th day of each calendar month, the Owner will make partial payment to the Contractor, but the Owner will retain 10% of the amount of each payment. Retaining 10% of each payment will continue until final completion and acceptance of all work covered by the contract. However, the Architect may upon approval by the Owner, at any time after 50% of the Contract Work has been completed and based on satisfactory workmanship, and progress has been attained, including written consent of surety, recommend that any of the remaining partial payments be stopped. The retainage will be paid to the Contractor after completion of the Contract for Construction and after the Contractor has submitted all Project Record Documents, Maintenance Manuals, Warranties and Guarantees (Close-Out Documents). No retainage shall be held on materials properly stored at the site or in the Contractor's bonded or insured warehouse if certificates of insurance or bond and invoices are provided."

9.6.1.1 Progress payments will be made for work completed or for materials delivered and properly stored, in accordance with subparagraph 9.6.1, through the Contracted Construction Period. No payments will be made after the Contracted Construction Period has expired until Final Payment, unless an extension of the Contract Time has been granted. in which case, an additional progress payment will be made for work performed during the extension time period only."

1.10 PARAGRAPH 9.8 SUBSTANTIAL COMPLETION

A. Add the following sub-subparagraphs 9.8.3.1 thru 9.8.3.3 as follows:

"9.8.3.1 If the Architect or any of the Architect's Consultants determines that the Work has still not reached Substantial Completion a second list of deficiencies will be issued to the Contractor.

9.8.3.2 Any additional inspections by the Architect or the Architect's Consultants to determine Substantial Completion will be considered additional services and will be billed directly to the Owner.

9.8.3.3 The Contractor will reimburse the Owner for expenses related to these additional services, or, the Owner may choose to withhold money from Progress Payment(s) or from retainage as reimbursement for additional services."

1.11 PARAGRAPH 9.10 FINAL COMPLETION AND FINAL PAYMENT

A. Add sub-subparagraphs 9.10.1.1 thru 9.10.1.4 as follows:

"9.10.1.1 If the Architect or any of the Architect's Consultants determines that the Work has not reached Final Completion a list of deficiencies will be issued to the Contractor.

9.10.1.2 Any additional inspections by the Architect or the Architect's Consultants to determine Final Completion will be considered additional services and will be billed directly to the Owner.

9.10.1.3 The Contractor will reimburse the Owner for expenses related to these additional services, or, the Owner may choose to withhold money from Final Payment or from retainage as reimbursement for additional services.

9.10.1.4 Before issuance of the final certificate, the Contractor shall obtain in writing from the bonding company approval of such payment. No certificate issued nor payment made to the Contractor, nor partial or entire use or occupancy of the Contract Work by the Owner, shall be an acceptance of any work or materials not in accordance with this contract."

9.10.1.5 Final payment will not be made until all project closeout documents are received from the Contractor and a release from the Contractor's Surety Company is received.

1.12 PARAGRAPH 11.1 CONTRACTOR'S INSURANCE AND BONDS

A. Delete subparagraph 11.1.2 and substitute the following:

"11.1.2 Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the work until date of final payment and termination of any coverage required to be maintained after final payment. The insurance required shall be written for not less than the following, or greater if required by law:

.1 Workers' Compensation:

(a)	State:		Statutory
(b)	Applicable Federal:		Statutory
(c)	Employers' Liability:	Per Accident:	$100,000
		Disease, Policy Limit:	$500,000
		Disease, Each Employee:	$100,000.

.2 Commercial General Liability (including premises-operations); independent contractors protective; products and completed operations) as follows:

(a) Coverage should apply at each work site. Limits required as follows:

(1)	General Aggregate:	Per Project:	$2,000,000
	Completed Operations:	Aggregate:	$1,000,000
	Personal Injury:		$1,000,000

Each Occurrence Limit: $1,000,000

(2) Products and Completed Operations to be maintained for one year after final payment.

(3) Property Damage Liability Insurance will provide X, C, or U coverage as applicable.

(b) Comprehensive General Liability. Coverage provided will be on the Comprehensive General Liability form with the Broad Form General Liability Endorsement. Limits provided as follows:

(1) Combined Single Limit: $1,000,000 each occurrence and aggregate

(2) Products and Completed Operations to be maintained for one year after final payment.

(3) Property Damage Liability Insurance will provide X, C, or U coverage as applicable.

(4) Contractual Liability:
Bodily Injury: Combined Single Limit
Property Damage: $1,000,000 Each Occurrence

(5) Personal Injury, with Employment Exclusion deleted:
Combined Single Limit
$1,000,000 Each Occurrence

(6) Bodily Injury and Property Damage (Combined Single Limit) (any auto, including Owned, Hired and Non-Owned Autos):
Bodily Injury: Combined Single Limit
Property Damage: $1,000,000 Each Occurrence"

(7) Umbrella Liability: $5,000,000

B. Add sub-subparagraph 11.1.2.1 as follows:

"11.1.2.1 The performance-payment bond shall be in compliance with the laws of the State in which the Work is to be performed and as stipulated in Document 00 61 13, Performance and Payment Bond, of these specifications."

C. Add sub-subparagraphs 11.1.3.1 and 11.1.3.2 as follows:

"11.1.3.1 The Contractor shall furnish one copy of each certificate of insurance herein required for each copy of the agreement which shall specifically set forth evidence of all coverage required by subparagraphs 11.1.1 and 11.1.2. Furnish to the Owner copies of any endorsements that are subsequently issued amending coverage of limits."

"11.1.3.2 The Contractor shall not commence work under this contract until he has obtained all insurance with responsible insurance companies satisfactory to the Owner required under this article, and such insurance has been accepted by the Owner. Nothing in this article shall create any obligation on the part of the Architect to see that the specified insurance is maintained."

D. Add subparagraph 11.1.5 as follows:

"11.1.5 All Subcontractors shall be required to maintain contractors liability insurance the same as required to be maintained by the Prime Contractor as specified in 11.1.1 and the limits of liability shall be not less than those required to be maintained by the Prime Contractor unless their operations are covered to the specified limits by the insurance maintained by the Prime Contractor."

1.13 PARAGRAPH 11.2 OWNER'S INSURANCE

A. Delete subparagraph 11.2.1 and substitute the following:

"11.2.1 The Contractor shall procure and maintain during the term of this contract, Owner's Protective Liability Insurance with an endorsement to the policy to include as additional insured, the Architect, with limits not less than $1,000,000 each occurrence and $1,000,000 in the aggregate for property damage liability."

B. Add subparagraph 11.2.2.1 as follows:

“11.2.2.1 Contractor shall procure and maintain during the life of this contract Builder’s Risk or Course of Construction (COC) Insurance, or installation Floater Insurance, and any extended coverage which shall cover damage for the project.”

1.14 PARAGRAPH 15.1 CLAIMS

A. Refer to sub-paragraph 15.1.5, Claims for Additional Time and add the following sub-subparagraph 15.1.6.3 as follows:

"15.1.6.3 In order for a claim for additional time due to adverse weather conditions to be considered valid, the Contractor must show that adverse weather conditions beyond those normally expected have occurred. For claims related specifically to "Rain Days" the following table of normal rain days will be employed to determine if the Contractor is entitled to a time extension. A "Rain Day" is defined as a 24 hour period in which 1/100" (.01) of rain or more falls and is recorded by the National Weather Service or other official reporting service in the immediate vicinity of the project. Extensions of time will be granted if the number of officially reported "Rain Days" is greater than normal during a given month. Claims for additional time must be submitted with the Contractor's monthly payment application for review. Failure to make timely and proper request for additional time will result in no time extension being allowed.

Average Days with 1/100" of Precipitation or More: Northeast Arkansas

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9	8	11	11	11	9	9	8	8	8	9	9

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT 00 73 00

PART 1 - GENERAL

1.01 EXCAVATION SAFETY PROCEDURES

A. In accordance with Arkansas Code Annotated § 22-9-212 et. seq., the Contractor shall include a separate pay item for trench or excavation safety systems for any trench or excavation which equals or exceeds five (5) feet in depth and this pay item shall be a part of the base bid.

B. The Occupational Safety and Health Administration (OSHA) Safety and Health Regulations for Construction, 29 CFR 1926, Subpart P - Excavations (07-01-2021 Edition), is hereby referenced and incorporated into this Project Manual and must be complied with at all times.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT 00 73 19.13

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PART 1 - GENERAL

1.01 CONTRACT BASIS

A. Work is based upon conditions at site, Project Manual, contract Drawings for WDD Project No. 24-096, all addenda issued and the Contract executed between Owner and Contractor.

1.02 OWNER

A. Wherever term "Owner" or "Owners" is used in the Contract Documents it refers to Craighead Electric Cooperative. All papers required to be delivered to Owner shall be delivered to Jason Gazaway, 3500 East Johnson Avenue, 3rd Floor, Jonesboro, AR 72401.

1.03 ARCHITECT

A. Wherever term "Architect" or "Architects" is used in the Contract Documents it refers to **Wittenberg, Delony & Davidson, Inc., 5050 Northshore Ln, North Little Rock, Arkansas 72118.**

1.04 TIME FOR COMPLETION

A. Time for completion shall be as stated in the Owner Contractor Agreement.

1.05 RESPONSIBILITIES OF CONTRACTOR

A. Except as otherwise specifically stated in the contract, Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, heat, power, transportation, superintendence, temporary construction of every nature, taxes legally collectible because of the Work and all other services and facilities of any nature necessary to execute Work as shown and/or specified under the contract and deliver it complete in every respect within specified time.

B. If, during the course of construction of this project, the Contractor discovers errors, inconsistencies or omissions in the Contract Documents, the Contractor will report them to the Architect who will issue written instructions to the Contractor. If the Contractor performs Work knowing there is an error, inconsistency or omission in the Contract Documents without giving notice to the Architect or receiving written instruction from the Architect, the Contractor assumes responsibility for the Work and will bear all costs associated with the performance or correction of the Work.

1.06 COORDINATION OF WORK

A. General Contractor to give special attention for coordination of work by various trades to provide uniform and symmetrical layout and spacing of exposed components which affect the finished architectural design and appearance. Where spacing and related locations are not specifically shown on the drawings, or where in doubt, Contractor's Superintendent shall consult Architect's Representative prior to installation of that part of the Work. Location of electrical and telephone outlets shall be verified with Architect prior to installation.

1.07 PRECONSTRUCTION CONFERENCE

A. Either before or soon after actual award of Contract (but in any event prior to start of construction), Contractor or his representative shall attend Preconstruction Conference with representatives of Owner and Architect. Conference will serve to acquaint participants with general plan of contract administration and requirements under which construction operation is to proceed, and will inform Contractor, in detail, of obligations imposed on him and his subcontractors.

1. Hold pre-installation meetings where select specified product systems required to meet warranty or guarantee, which may include Contractor, Architect, Engineer, Consultant, Installer, Owner’s Representative, and Manufacturer’s Designated Representative.

1.08 CONSTRUCTION DRAWINGS AND SPECIFICATIONS

A. Architect to furnish one (1) set of contract drawings and specifications, without cost, to Construction Manager for use in constructing Work. Construction Manager shall supply all contract drawings and specifications to his subcontractors or material suppliers. - Additional sets or partial sets of Bidding Documents (including addenda) requested by Construction Manager, will be furnished for actual cost of printing, handling and shipping costs at Construction Manager’s expense. Bidding Documents may also be obtained in electronic format through Southern Reprographics at www.sriplanroom.com for a non-refundable fee as pre-determined by level of access.

1.09 DEFINITION

A. The word "Provide", as used throughout these specifications, means furnish and install.

1.10 REFERENCE STANDARDS

A. Except as otherwise noted, references throughout Project Manual to Codes, Federal Specifications, ASTM Standards, Association or Industry Specifications and other published standards, are to latest edition or publication of such standards.

1.11 PERMITS

A. Utilizing the contract documents (Project Manual and Drawings) prepared by the Architect and his Consultants, along with information provided by the Owner or his Consultants, the Contractor is responsible for securing permits required to successfully complete the project. This responsibility includes payment for the permit and coordination of all submittals.

B. Storm Water Discharge Permit: Contractor shall be responsible for obtaining this permit from Arkansas Department of Environmental Quality for construction sites where **one (1) acre** or more is disturbed, and meet all other storm water regulations. Contractor shall keep a copy of his Storm Water Discharge Permit on the job site at all times.

1.12 INFORMATIONAL DRAWINGS

A. Drawings bound into working drawing set and labeled as informational drawings are not part of the Contract Documents. Information on these drawings is for reference and coordination only and is not a representation or warranty of existing or proposed conditions. The Architect and Owner are not responsible for interpretations or conclusions made by the Contractor based on these drawings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 11 00

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PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Definitions and Explanations: Requirements of work related to each allowance are shown and specified in contract documents. The allowance has been established in lieu of additional requirements for that work, and further requirements thereof will be issued at a later time.

B. Cash allowances stipulated in specifications for this project shall not be made a part of any subcontract agreement by Contractor until materials, work and/or services stipulated have been selected by Owner or Architect. For allowances for materials and installation under a subcontract, Architect will issue supplemental specifications to Contractor to receive a minimum of three (3) subcontract bids for work under the allowance unless instructed otherwise by the Architect.

1.02 SCHEDULE OF ALLOWANCES

		Section	Amount
A.	Testing and Inspecting Services	01 45 23	$5,000
B.	Signage - Interior (Doors)	10 14 00	$4,000
C.	Signage - Exterior (Job Site Sign)	10 14 00	$1,500

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 21 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Unit Price quotations shall be inserted in the appropriate spaces in the Bid Form for each Unit Price item of Work described herein.

B. Unit Prices stated in the Agreement shall be used to compute adjustments of the Contract Sum for approved Unit Price items of Work. Such adjustments shall be made by Change Order.

C. Unit Prices shall include all labor, materials, tools, and equipment; all other direct and indirect costs necessary to complete the item of Work and to coordinate the Unit Price Work with adjacent Work; and shall include all overhead and profit. Contractor shall accept compensation computed in accordance with the Unit Prices for work installed in place as full compensation for furnishing such Work.

D. Compensation will be paid for those items of Work described in below, Unit Prices.

1.02 SPECIFIED WORK

A. Applicable Sections of the Specifications describe the materials and methods required under the various Unit Price items of Work.

1.03 UNIT PRICES

A. The Bidder shall **include in the Base Bid** the following lump sum allowances computed based upon the quantities listed and unit costs indicated. Unit prices include all Contractor cost including labor, material, General Conditions and overhead and profit. Bidder understands that the Owner reserves the right to review and or negotiate Unit Prices that are deemed to be not in accordance with current market value of proposed services.

1. In the event the actual quantities are greater or less than the given volumes, the unit prices stated will be used to adjust the contract accordingly.

B. List of Unit Price Items and Descriptions:

1. **Unit Price No. 1:** Undercut and related replacement fill.

   Unit Price per Cubic Yard: $ _____ per CY

2. **Unit Price No. 2:** For importing, placing and compacting select fill material at undercut areas only. This is in addition to the fill material required to establish grades shown on the drawings which is to be included in the Base Bid.

   Unit Price per Cubic Yard: $ _____ per CY

1.04 ADVANCED COORDINATION

A. Immediately notify the design professional when conditions require the use of Unit Price items of Work.

B. The applicability of, measurement methods for, documentation of, and the final adjustment of the Contract Sum for Unit Price items of Work shall be determined by the design professional.

C. After performing Unit Price items of Work as directed by the design professional, Contractor shall take necessary measurements in the presence of Owner's Representative and shall submit calculations of quantities to Owner's Representative for approval. Contractor shall notify Owner's Representative one day in advance of taking measurements.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 22 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Make submittals required by Contract Documents; revise and resubmit as necessary to establish compliance with specified requirements. Submittals which are received from sources other than through the General Contractor's office will be returned by the Architect without action. Submit at least one original of manufacturer's product literature. The remainder of the number of copies required for submittal may be reproductions of manufacturer's literature. **FAX submittals, poor quality reproductions or illegible submittals will not be accepted.**

B. Contractor's submittal of (and Architect's review of) shop drawings, product data or samples which relate to work not complying with requirements of Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section.

1.03 QUALITY ASSURANCE

A. Coordination of Submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted. By affixing Contractor's approval stamp to each submittal, certify that coordination has been performed.

B. Verify that each item and submittal for it conform in all respects with specified requirements.

C. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Construction Manager. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.

1.04 TIMING OF SUBMITTALS

A. General: Make submittals far enough in advance of scheduled dates of installation to provide required time for reviews, securing necessary approvals, possible revision and resubmittal, placing orders and securing delivery.

B. Owner will not bear costs of delays due to late submittals.

1.05 COORDINATION AND SEQUENCING

A. Coordinate preparation and processing of submittals with performance of work so that work will not be delayed by submittals.

B. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect's review with another.

1.06 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the architect.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents. **Bookmark individual submittals exceeding 20 pages, and those with multiple products and systems integrated into a single submission.**

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied.

D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the architect.

E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the architect’s computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.

F. Provide hard copies of submittals when requested by the architect. Up to 3 additional hard copies of any submittal may be requested at the discretion of the architect, at no additional cost to the owner.

PART 2 - PRODUCTS

2.01 PROGRESS SCHEDULE

A. Within 7 days after Notice to Proceed, submit to Architect a bar-chart type progress schedule indicating time bar for each trade or operation of work to be performed. Time bar shall demonstrate planned work, properly sequenced and intermeshed, for expeditious completion of Work. Identify phases if required.

B. Distribute progress schedule including all updates to Architect, Owner, subcontractor, suppliers, fabricators, and others with need-to-know schedule compliance requirements. Post copy in field office.

2.02 SCHEDULE OF VALUES

A. Immediately after execution of the Contract Documents, Contractor shall submit for approval a Schedule of Values totaling the amount of the Contract.

2.03 LIST OF SUBCONTRACTORS

A. Immediately after execution of the Contract Documents, Contractor shall submit for approval a listing of all subcontractors to be used for the project stating portions of Work to be performed, address and telephone number of firm, and contact at firm familiar with project.

B. If all subcontrators have not been determined, submit a partial listing with regular updates indicating newly added subcontractors.

2.04 SUBSTITUTION REQUESTS

A. Products specified herein establish a quality standard for comparison by manufacturers of similar products. Products of other manufacturers may be substituted for those specified herein on an "Approved Equal" basis. DO NOT propose the substitution of products that do not meet or exceed the quality standards established by the specified product. Products proposed as equivalent MUST be submitted through the General Contractor for review by the Architect after the Contract for Construction is awarded. DO NOT request approval of products prior to the awarding of the contract.

B. Requests for substitution will be reviewed when extensive revisions to contract documents are not required and changes are in keeping with general intent of Contract Documents; when timely, fully documented and properly submitted; and when one or more of following conditions is satisfied, all as judged by Architect/Engineer. Otherwise, requests will be returned without action except to record non-compliance with these requirements.

1. Where request is directly related to an "or equal" clause or other language of same effect in Contract Documents.
2. Where required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the Work promptly or to coordinate various activities properly.
3. Where required product, material or method cannot be provided in a manner which is compatible with other materials of the Work, or cannot be properly coordinated therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial non-compliance items which are not possible to otherwise overcome except by making requested substitution, which Contractor thereby certified to overcome such non-compatibility, non-coordination, non-warranty, non-insurable or other non-compliance as claimed.

4. Where required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.

C. **SUBSTITUTIONS REQUESTS MUST BE SUBMITTED WITHIN 45 DAYS AFTER THE DATE OF THE NOTICE TO PROCEED**. Substitution requests received after that time will be returned and the Contractor will be required to provide the product specified, except in the following instances:
   1. Unavailability of product, material or method, not due to the Contractor's failure to pursue the work promptly or to coordinate various activities properly.
   2. Where a specified product or material contains a hazardous material, as defined in 40 CFR 261 and as defined by applicable state and local regulations and of which the Owner and Architect refuse to approve for use, based on Contractor furnished information.

D. Submit request for substitutions in writing using the Substitution Request form found at the end of this Section. This is the only form that will be accepted.

E. Submit 3 copies of substitution request, fully identified for product or method being replaced by substitution, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include manufacturer's product data/drawings, description of installation methods, material samples where applicable, complete color and finish selection cards or samples, Contractor's detailed comparison of significant qualities between specified item and proposed substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitutions will result in overall work equal-to-or-better-than work originally indicated.

F. Failure to provide the requested data and samples within the specified time frame will be grounds for rejection as a comparable product.

G. Do not incorporate substitutions into Shop Drawings until they have been reviewed by the Architect and written permission has been issued to make the proposed substitution a part of the contract.

H. Under no circumstances shall Architect's review of any such substitution relieve Contractor from timely, full and proper performance of Work.

I. In the event that the substitution of a product by the General Contractor necessitates the redrawing, redesign, modification or other change to the Contract Documents, the General Contractor will bear all associated costs of these changes.

2.05 REQUEST FOR SUPPLEMENTARY INFORMATION

A. Make timely requests of Architect for additional information required in planning and production of Work.

B. File requests in ample time to permit appropriate action by all parties involved and avoid delay in performance of Work.

C. Owner will not bear costs for delays due to Contractor's failure to request information in a timely manner.

2.06 SHOP DRAWINGS

A. Provide newly-prepared information, on reproducible sheet formats, with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name). Do not duplicate and submit Architect's construction drawings as shop drawings. Show dimensions and notes which are based on field measurement. Identify materials and products in work shown. Indicate compliance with standards, and special coordination requirements. **DIGITAL SUBMISSIONS ARE ALLOWED**.

B. Shop drawings must bear Contractor's approval stamp. This approval stamp certifies that the Contractor has reviewed the shop drawings, product data, samples or similar submittals for conformance with the Contract Documents. All deviations will be noted in writing and highlighted on the submittal for Architect's review. The Architect is not responsible for errors, omissions or deviations in the shop drawings, product data, samples or similar submittals by the Contractor.

C. Submittals are reviewed by the Architect for design intent only. The Contractor is responsible for verification of dimensional requirements, compliance with contract documents and local codes, quantities and coordination of all affected trades.

D. Under no circumstances shall Architect's review of shop drawings or submittals relieve Contractor from timely, full and proper performance of Work in accordance with the Contract Documents.

E. Contract Documents (including all drawings, specifications, addenda and supplemental information) will not be made available in any digital format or on any other reproducible media to Prime Bidders or Sub-bidders before the award of a Contract nor will they be made available to the Contractor or Sub-contractors after the award of a Contract. Prime Bidders may obtain Bidding Documents in electronic or paper format through Southern Reprographics at www.sriplanroom.com for a non-refundable fee as pre-determined by level of access.

F. CAD files will be available to the successful Contractor or Sub-contractors with a release letter or per AIA Document C106™ - 2013 Digital Data Licensing Agreement, after the award of a Contract.

2.07 PRODUCT DATA

A. Collect required data into one submittal for each unit of work or system; mark each copy to show which choices and options are applicable to project AND WHICH ARE AVAILABLE FOR SELECTION BY THE ARCHITECT WITHOUT ADDITIONAL COST. NO PAYMENT WILL BE MADE FOR ADDITIONAL COST OF ANY CHOICES OR OPTIONS SUBMITTED BY THE CONTRACTOR FOR SELECTION BY THE ARCHITECT AND NOT CLEARLY SHOWN AS NOT AVAILABLE WITHIN THE CONTRACT.

B. Include manufacturer's standard published recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements.

C. Maintain one set of product data (for each submission) at project site, available for reference by Architect and others.

D. Do not submit product data until compliance with requirements of contract documents has been confirmed by Contractor.

E. Copies:
   1. Submit 3 paper copies of product data for Architect's review for items specified in various specification sections, **unless digital submission**.
   2. Three paper copies required for mechanical and electrical data, **unless digital submission**.

F. Installer's Copy: Do not proceed with installation of materials, products or systems until final authorized copy of applicable product data is in possession of installer.

G. **Material Safety Data Sheet (MSDS):** MSDS provides basic information on a material or chemical product. A MSDS describes the properties and potential hazards of the material, how to use it safely, and what to do in an emergency. DO NOT PROVIDE WITHIN A SHOP DRAWING SUBMISSION UNLESS SPECIFICALLY REQUESTED BY THE DESIGN PROFESSIONAL. MSDS information shall be kept on file with the contractor and subcontractors for reference. Refer to OSHA MSDS Rules for clarification at website: https://msdsauthoring.com/msds-safety-data-sheet-chemicals-osha-msds-rules.

2.08 SAMPLES

A. Unless precise color and pattern is specified in Contract Documents, submit accurate color and pattern charts or actual material samples to Architect for selection. Refer to pertinent sections of specifications for detailed submission requirements. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples (not less than 3 units) where unavoidable variations must be expected, and describe or identify variations between units of each set.

B. Make all submissions affecting color selection within sufficient time to allow selection without causing delay in Work.

C. Submit items requiring color selection or verification AS ONE SUBMISSION to facilitate coordination of all colors at one time. Interior items may be submitted separately from exterior items.

D. Provide full set of optional samples where Architect's selection is required. DO NOT INCLUDE OPTIONS REQUIRING ADDITIONAL COST.

E. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by Architect. Architect will not "test" samples (except as otherwise indicated) for compliance with other requirements, which are therefore the exclusive responsibility of Contractor.

F. Submit 3 sets of samples in final submittal.
   1. Furnish two sets to Architect and assemble one set on site. When all samples are on site, Owner and Architect are to review. Contractor shall provide job samples indicating finished color selections for any and all items requiring finish color for project.
   2. Quality Control Set: Maintain returned final set of samples at project site, in suitable condition and available for quality control comparisons by Architect and Owner. Written approval from Owner is required before the work is begun for any finish requiring color review.

G. Reusable Samples: Returned samples which are intended or permitted to be incorporated into Work must be in undamaged condition at time of use.

2.10 STRUCTURAL SUBMITTALS

A. Structural submittals, where required, include shop drawings, design calculations, diagrams, illustrations, schedules, performance charts, nomenclature charts, samples, brochures and other data prepared by the Contractor or any subcontractor, manufacturer, supplier, fabricator, or distributor and which illustrate some portion of the Project directly related to the structural design of the project.

B. Contractor shall make all submittals in advance of installation or construction to allow sufficient time for review.

C. Work requiring shop drawings, whether called for by the Contract Documents or requested by the Contractor, shall not commence until the submission has been reviewed by the Architect/Structural Engineer. Work may commence if the Contractor verifies the accuracy of the Architect/Structural Engineer's corrections and notations and complies with them without exception and without requesting change in Contract Sum or Contract Time.

2.11 ALTERNATE LIGHTING PACKAGES

A. Photometric and lighting calculations for each package are required to compare to the calculations and photometrics previously designed into the project.

B. Design professional must verify and have substation requests, and cut sheets for every fixture in each package, to compare with original design previously approved. Verify that wattage and lumen output is equivalent and each fixture type meets the design intent of the building, including the same relative warranty time frame.

PART 3 - EXECUTION

3.01 SUBMITTAL PREPARATION

A. Permanently mark each submittal to identify project, date, Contractor, subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking.

B. Indicate project, date, "To:"; "From:"; names of subcontractors, suppliers, manufacturers, required references, category and type of submittal, purpose, description, distribution record and signature of transmitter.

C. Indicate drawing number and specifications section number to which submittal applies.

3.02 ARCHITECTS ACTION ON SUBMITTALS

A. Architect will respond to submittals from Contractor by completing the "LETTER OF TRANSMITTAL" form.

B. Architect's Submittal Review: Submittal review does not relieve Contractor(s) of compliance with Contract Documents or local codes. Review is only for conformance with the design intent of the Project and compliance with information given in the Contract Documents. The contractor is responsible to coordinate and to confirm all dimensions for use at the site. The contractor is responsible for coordination of the work of all trades.

C. Architect's Action: Where action and return is required or requested, Architect will review each submittal and mark per the following, and where possible return within fifteen (15) working days of receipt. When a submittal must be coordinated with submittals of other trades, Contractor is responsible for gathering all information and forwarding to Architect as a single submittal.

D. Architect's Response:
1. Final Unrestricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following: **Marking: "Reviewed".**
2. Final-But-Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following: **Marking: "Reviewed and Noted".**

3. Returned for Resubmittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the Work: **Marking: "Revise and Resubmit".**
4. Other Action: Where submittal is returned for other reasons, with Architect explanation included, it will not be marked or marked "Revise and Resubmit".

END OF SECTION 01 33 00

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WITTENBERG, DELONY & DAVIDSON, INC.
5050 Northshore Ln
North Little Rock, AR 72118
Tel: 501-376-6681 Fax: 501-372-6317

SUBSTITUTION REQUEST

WDD does NOT Pre-Qualify before bidding
To Be Submitted AFTER Award of Contract

Project:
Project No:

Date:
Contractor:
Contact Person:

Contractor hereby requests consideration of a product substitution as follows:

1. Refer To: Section - _____ and/or Drawing - _____
2. Item Description: _____
3. Proposed Substitution:
   Manufacturer: _____
   Model Number: _____
   Description: _____
4. Reason for Substitution:
   ___ Availability
   ___ Delivery Schedule
   ___ Cost Advantage
   ___ Quality Advantage
   ___ Performance Advantage
   ___ Other: _____
5. Coordination:
   Difference in dimensions between the specified and proposed substitute **(WILL) (WILL NOT)** affect dimensions on drawings and adjacent items.

   Describe the effect of the substitution on work of other trades: _____

   Describe the effect of the substitution on other required new or existing materials including electrical wiring, piping, ductwork, finishes, structure, etc.: _____

   Acceptance of this substitution will cause **(NO CHANGE IN) (A REDUCTION OF_____ DAYS FROM)** the completion date of this project.

   Describe any required architectural or engineering design changes required to accommodate the substitution: _____
6. Differences:
   The proposed substitution **(MEETS) (DOES NOT MEET)** the reference standards (ASTM, AWI, UL, etc.) as specified.

   The proposed substitution **(MEETS) (DOES NOT MEET)** the fire rating classification (class, type, FM, UL, NFPA) as specified.

   The proposed substitution is available in the following **(COMPARABLE) (LIMITED) (ADDITIONAL)** finishes.

   Note: Any additional cost associated with proposed substitute finishes will be absorbed by the contractor if this substitution is approved and implemented.

7. Warranty:
   Specified Warranty Length and Coverage:_____
   Substitute Warranty Length and Coverage (Sample warranty attached):_____
   _____
8. This substitution will result in a cost savings and credit of $_____.
9. The proposed substitute has been used in the following installations (attached):_____
   _____
10. Service and replacement material are available from the following (attached):_____
    _____

By submitting this Request for Substitution, the Contractor accepts the following terms and conditions:

1. The proposed substitution, if accepted, will provide performance equivalent to the material or equipment specified. Should a substitution be accepted and should the substitute material or equipment prove defective or otherwise unsatisfactory for the service intended, the Contractor will replace the material or equipment with the material or equipment specified.
2. If the substitution will affect a correlated function, adjacent construction, or work of other trades or contractors, the necessary changes and modifications to affected work are considered to be part of the substitution and will be accomplished without additional cost to the Owner.
3. In the event that the substitution of materials or equipment necessitates the redrawing, redesign, modification or other change to the Contract Documents, the General Contractor will bear all associated costs of these changes.

Contractor warrants that they have verified and believe this substitute is equal or superior to the specified item in all respects. There will be no additional cost associated with coordinating installation of this substitute. Costs and effects of the substitution, as outlined herein, are certified and complete. Claims for additional costs related to acceptance of this substitution, which may become apparent later, are waived.

Manufacturer's product cut sheets, drawings, samples, data sheets, sample warranties, manufacturer's certification, etc. for the substitute are attached.

Contractor:_____ Date:_____

By:_____

Typed Name:_____

Architect's Action:

_____ Substitution is Accepted
_____ Substitution is Rejected for the following reason(s):_____
_____

By:_____

Typed Name:_____

Date:_____

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Testing laboratory services and inspection services.

B. Contractor to include, in Base Bid, cost of all field and laboratory testing which is required by various sections of Technical Divisions of these specifications. This will include, but is in no way limited to the following tests:

1. Soil Compaction
2. Soil Bearing
3. Parking Lots:
    a. Subgrade Densities
    b. Base Course Densities
    c. Asphalt Densities
    d. Core Samples to Determine Asphalt Thickness
4. Concrete:
    a. Making Test Cylinders
    b. Compression Tests
    c. Concrete floor moisture vapor emission, in-situ relative humidity and pH (alkalinity) testing at concrete substrates scheduled to receive finish flooring as indicated on Drawings and/or specified in various finish flooring sections. Refer to current version of ASTM F 2170.
        1) Testing shall be conducted based on flooring moisture and pH tolerance requirements submitted by finish flooring trades.
        2) Areas failed to achieve the required moisture and/or pH levels shall be re-mitigated and re-tested at no additional cost to the Owner.
        3) Moisture vapor and pH Test results shall be signed off by respective flooring manufacturers and installers to obtain full warranty on flooring product and installation.
        4) The Owner may conduct and pay for his own random moisture and pH tests at his sole discretion to verify and confirm Construction Manager's test results.
        5) Information on grout mixing and placement, and on grout testing is contained in Grouting Concrete Masonry Walls, **TEK 3-2A** and Grout Quality Assurance, **TEK 18-8B** (refs. 1,2), respectively, as published in the National Concrete Masonry Association (NCMA).
5. Structural Steel Welding
6. Roofing, including Fastener Pull Out Tests per ANSI/SPRI FX-1.
7. Other tests required by Specification Sections
8. Hazardous Material Testing related to discovery

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALIFICATIONS OF LABORATORIES

A. Meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories.

B. Meet basic requirements of ASTM E329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as used in Construction".

C. Authorized to operate in state where project is located.

D. Testing equipment must be calibrated at reasonable intervals by devices of accuracy, traceable to either National Bureau of Standards or accepted values of national physical constants.

1.05 LABORATORIES DUTIES

A. Perform specified inspections, sampling and testing of materials and methods of construction. Comply with specified standards. Ascertain compliance of materials with requirements of projects.

B. Promptly notify Architect and Contractor of observed irregularities or deficiencies of work or products.

C. Promptly submit written report of each test and inspection; two copies to Architect and one copy to Contractor for record document files. Each report shall include the following:
   1. Date issued
   2. Project title and number
   3. Testing laboratory name, address and telephone number
   4. Name and signature of laboratory inspector
   5. Date and time of sampling or inspection
   6. Record of temperature and weather conditions
   7. Date of test
   8. Identification of product
   9. Location of sample or test in project

10. Type of inspection or test
11. Results of tests and compliance with contract documents
12. Interpretation of test results, when requested by owner or owner's representative.

1.06 LIMITATIONS OF AUTHORITY OF TESTING LABORATORIES

A. Laboratories shall not be authorized to release, revoke, alter or enlarge on requirements of contract documents; approve or accept any portion of work or perform any duties of Contractor or Architect.

1.07 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to work and operations.

B. Secure and deliver to laboratory adequate quantities of representational samples of materials proposed to be used which require testing.

C. Provide laboratory with preliminary design mix proposed to be used for concrete and other materials mixes which require control by testing laboratory.

D. Furnish copies of manufacturer's test reports of products as required.

E. Furnish incidental labor and facilities as follows:
   1. To provide access to work to be tested.
   2. To obtain and handle samples at project site or at source of product to be tested.

1.08 SPECIAL INSPECTIONS

A. Special inspections shall be required in accordance with Chapter 17 of the Building Code. The construction manager (CM) shall be responsible for coordinating all inspections with relevant inspection agency.
   1. Arkansas Special Inspections Guidelines and Special Inspection Forms, revised January 01, 2023, may be downloaded from the Structural Engineers Association of Arkansas website at www.seaoar.org/resources and comply with the 2021 AFPC (2021 IBC in conjunction with the State of Arkansas Amendments), hereafter referred to as the Building Code.

B. Special Inspector shall keep respective records of inspections. Inspection reports shall be submitted to the Building Official or Authority Having Jurisdiction (AHJ) and to the registered design professional in responsible charge.

C. Reports shall indicate that inspected work was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official (AHJ) and the registered design professional in responsible charge, prior to the completion of that phase of the work.

D. A final report of inspections documenting required Special Inspections, and correction of any discrepancies, shall be submitted to the Owner, Building Official (AHJ) and the registered design professional in responsible charge at the completion of respective portion(s) of the work.

1.09 HAZARDOUS MATERIAL ABATEMENT

A. During the construction of this project, if work involving hazardous material is suspected, or encountered, Contractor shall notify Owner or Owner's representative immediately and Owner, with his own forces or by separate contract is responsible for complete investigation, removal and disposition of hazard material in accordance with applicable laws and regulations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample taking and similar services performed on the work, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed finishes. Protect work exposed by or for testing activities and protect repaired work.

END OF SECTION 01 45 23

PART 1 - GENERAL

1.01 GENERAL SITE REQUIREMENTS

A. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways.

B. Ensure safe passage of persons around areas of construction. Conduct operations to prevent injury to adjacent buildings, structures, facilities and persons.

C. Erect temporary covered passageways as required by authorities having jurisdiction.

D. Provide dust-proof partitions if required. If not indicated on the drawings, provide dust-proof partitions as directed by the Architect to comply with applicable sections of the Life Safety Code.

E. Provide temporary enclosures at doors and other openings in walls as necessitated by weather conditions. Construct enclosures with fire retardant treated lumber. Tape joints and caulk to prevent dust and debris from migrating beyond construction areas. Maintain enclosures in good repair and remove when no longer needed.

F. Provide interior and exterior shoring, bracing or support as needed to prevent movement, settlement or collapse.

1.02 PROJECT SIGNS

A. Subject to prior approval of Owner as to size, design, type, location and to local regulations, Contractor and his subcontractors may erect temporary signs for purposes of identification and controlling traffic.

B. Additional banner signs with grommets may be provided by the Architect to be placed as directed. Signs shall be maintained throughout the project then returned to architect's site representative or discarded after verification with architect.

C. Construction Manager shall furnish and erect temporary construction sign at job site and remove sign at end of construction period. Paint and letter as directed by Architect to identify project, Owner, Architect and Contractor. Refer to general sign drawing (s) following this Section for reference and to Section 01 21 00 - Allowances.

1.03 JOB OFFICES AND STORAGE

A. Contractor and his subcontractors shall maintain office and storage facilities on site as may be necessary. Locate so as to cause no interference with work to be performed on the site by Owner or with Owner's operations. Consult with Architect regarding locations. Office shall have as a minimum the following items:
   1. Complete set of Construction Documents including all addenda and supplemental information.
   2. Telephone and fax machine.
   3. Layout and meeting space for Architects or Owners representative to use when visiting the site.
   4. Complete job file with copies of all correspondence concerning the project.
   5. Other standard office equipment as is normally required to operate a business.

B. Upon completion of project, or as directed by Architect, Contractor shall remove temporary structures and facilities from the site, same to become his property. Leave the premises in condition required by Contract.

1.04 SANITARY ARRANGEMENTS

A. Contractor, at beginning of Work, to provide on premises suitable temporary convenience and enclosure for use of workmen on job. Maintain in sanitary condition and remove at completion of Work or when directed by Architect.

1.05 TEMPORARY UTILITIES FOR CONSTRUCTION

A. Provide all gas and electric service for heating, cooling, lighting and power required for construction purposes.

B. Provide all water required for construction purposes. Run temporary lines and provide necessary standpipes.

C. Contractor to pay all utility charges until time of substantial completion.

1.06 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise directed. Allow other entities to use temporary services and facilities without cost, including, but not limited to Construction Coordinator, Design Professional, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Water Service from Existing System: Water from Owner's existing water system is available for use with metering and with payment of use charges. Provide meter connections and extensions of services as required for construction operations.

1.07 TEMPORARY HEATING

A. Provide temporary heating, coverings and enclosures necessary to protect operations and materials against damage by dampness and cold, to dry out work, and facilitate completion of Work.

B. Maintain critical installation temperatures required in separate Sections of the Specifications. Repair or replace at no additional cost to Owner, any materials and work damaged by dampness, insufficient or abnormal heat.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 50 00

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PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. The contractor is responsible for implementing Erosion Control measures in accordance with State and Federal requirements. The information provided on the Drawings should be considered a minimum for the anticipated construction and conditions. The contractor shall be responsible for adding additional measures as conditions change, at no additional cost to the Owner, as required by the design professional if warranted by site conditions and Contractor's maintenance of site. Additional straw mulch, silt fencing and rip-rap shall be stockpiled on site to quickly maintain or expand erosion control measures as needed due to changing weather and site conditions.

B. This Section includes the following:
   1. Silt fence, diversion ditches and rock ditch checks.
   2. Rock protection at ditch and pipe outfalls (Quarry Spalls, i.e., "Rip-Rap")
   3. Surface stabilization (seed, sod, poly-ethylene sheeting)
   4. Measures to keep streets clean.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 DESIGN REQUIREMENTS

A. Provide temporary application of mulch cover as a deterrent to soil erosion.

B. Provide baled straw between project earthwork operations and adjacent areas to prevent scouring, and eroding of soil, and silt runoff.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mulch Cover: Straw from threshed rice, oats, wheat, barley or rye; of wood excelsior; or from hay obtained from various legumes or grasses, such as lespedeza, clover, vetch, soybeans, bermuda, carpet sedge, bahia, fescue or other legumes or grasses, or a combination thereof. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds, and shall not be excessively brittle or in an advanced state of decomposition. All material will be inspected and approved prior to use.

B. Filter Fabric: Typar 3401, Trevira S1115, or approved equal non-woven polypropylene or polyester fabric.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Ensure that earthwork and final grading in area requiring erosion control have been brought to grade as required by Contract Documents.

3.02 INSTALLATION

A. Silt Fence: Fence post spaced no more than 10 feet apart and driven a minimum of 2 feet into ground. Post shall extend minimum of 2 feet above grade. Fasten metal mesh fence with 6 inch or smaller openings to fence posts to reinforce the silt fence fabric. Mesh fence to extend 2 feet above grade and 4 inches into grade. Mesh may be omitted if reinforced silt fence fabric is used or in areas of low flow.

B. Non-vegetative Soil Stabilization: Utilize temporary non-vegetative soil stabilization to provide protection against excessive soil erosion over a short period of time. Required in areas that experience high water flows and high runoff velocities and at disturbed slopes steeper than 2:1.
   1. Mulch: Apply at 1.5-2.5 tons per acre.
   2. Anchor by peg and twine, mulch netting, erosion control, fabric, jute matting or mulch anchoring tool.

END OF SECTION 01 57 13

PART 1 - GENERAL

1.01 CLEANING AND WASTE REMOVAL

A. Progress Cleaning:
   1. The premises and the job site shall be maintained in a reasonable neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and other flammable waste materials or trash from the work areas at the end of each working day. Do not allow debris to blow onto adjoining properties. Respond immediately to request from adjoining property owners to remove any debris that does manage to show up on adjoining properties. Collect and remove waste materials, debris, and rubbish from site weekly, daily if necessary and dispose off-site.
   2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
   3. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

B. Final Cleaning:
   1. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
   2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
   3. Complete following cleaning operations before requesting inspection for Substantial Completion, where applicable to project scope:
      a. Clean Project Site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains, and other foreign deposits. Rake grounds to a smooth even-textured surface.
      b. Remove tools, construction equipment, machinery, and surplus material from Project Site.
      c. Remove snow and ice to provide safe access to building.
      d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
      f. Broom clean concrete floors in unoccupied spaces.

g. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.

h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped, scratched, or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Do not use razor blades to clean glass. Any scratches on the glass caused by the cleaning process will be cause for the removal and replacement of the damaged glass at the Contractor's expense.

i. Remove labels that are not permanent labels.

j. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.

k. Wipe surfaces of mechanical and electrical equipment, and other similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.

l. Plumbing fixtures are to be cleaned to a sanitary condition, free of stains, including stains resulting from water exposure.

m. Replace all disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.

n. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.

o. Leave Project clean and ready for occupancy.

4. Engage an experienced licensed exterminator to make a final inspection, and rid Project of rodents, insects, and other pests. Comply with regulations of local authorities having jurisdiction.

5. Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction.

6. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from Project Site and dispose of in accordance with requirements of local authorities having jurisdiction.

   a. Extra materials of value that remain after completion of construction and have become the Owner's property are to be stored as directed by Owner.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 01 74 23

PART 1 - GENERAL

1.01 DESCRIPTION

A. **Upon completion of Work and prior to final payment**, a digital electronic copy of the following items must be submitted to Architect, tabbed and with a Table of Contents conforming to the current version of the CSI MasterFormat. Formatted items may be submitted on a thumb drive or via Microsoft OneDrive file hosting service (OneDrive also works as the storage backend of the web version of Microsoft 365 / Office cloud storage):

1. General Contractors letter of warranty
2. General Contractors letter stating that all deficiency list items are complete
3. Lien releases
4. Consent of Surety to pay final retainage
5. List of all subcontractors and suppliers, including portions of the work performed, address and telephone number of firm, and a contact name familiar with the project. Two (2) copies. One copy in each binder.
6. Guarantees and Warranties: Refer to specific sections of Project Manual for general requirements on warranties, product/workmanship bonds, and maintenance agreements. Furnish two (2) fully executed copies of each guarantee and warranty specified for review by Architect, one copy in each binder.
7. Certificates: Fully executed copy of each certificate specified, where applicable:
    a. Certificate of Occupancy
    b. Final Termite Inspection
    c. Final Plumbing Inspection
    d. Final Electrical Inspection
    e. Certificate of Air Balance
8. Miscellaneous other inspection reports, where applicable:
    a. Boiler and Tank
    b. Elevators and Hoist Systems
    c. Backflow Preventers on Potable Water
    d. Fire Suppression System
    e. Fire Alarm System
    f. Security System
    g. Backup Power Generator
    h. Cable Test/Certification Reports and Startup Records
9. Instructions: Operating, service and maintenance manual or instruction sheet for each item as requested by specifications and required for Owner’s use.
10. Building hardware packet as described in Section 08 71 00, if applicable.
11. Shop Drawings: A complete file of final copies of all shop drawings used in construction of project.
12. Complete set of all submittals for products used in construction of project.

B. Project Record Drawings: The Contractor shall provide one (1) complete set of project record drawings and two (2) CD's of scanned images of the drawings.

1. Cloud and reference each of the following items on the Record Drawings:
   a. written addendum items
   b. addendum drawings
   c. "X" drawings
   d. Supplemental Instructions
   e. Change Orders
   f. responses to RFI's
   g. any other deviations from the original drawings that are made in the field
2. Record final locations of underground lines by depth from finished grade and by accurate horizontal offset distances to permanent surface improvements such as buildings, curbs, edges, or walks.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.01 EXTENDED WARRANTIES

A. The entire project is warranted for a period of one (1) year from the date of substantial completion and several materials and systems require extended warranties. It is the responsibility of the General Contractor to review the Project Manual to determine the term of the extended warranties and provide the extended warranties required.

END OF SECTION 01 78 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Site preparation includes, but is not necessarily limited to:
   1. Temporary fencing and protective barricades.
   2. Protection of trees and shrubs to remain.
   3. Felling of trees removed, removal of stumps, roots and debris from Work.
   4. Removal of obstructions which interfere with Work.
   5. Stripping of topsoil and vegetation from earth areas of site.
   6. Removal of concrete and removal of asphaltic concrete pavement.
   7. Abandonment and capping wells or cisterns.
   8. Demolition and removal of buildings or building elements.
   9. Protection of active utilities and removal of utilities abandoned.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Workmen Qualifications: One person present during tree clearing and grubbing operations, thoroughly familiar with types of trees involved. Direct trimming of roots and limbs where required.

B. Codes and Standards: Comply with pertinent codes and regulations, plus requirements of insurance carriers providing coverage for Work.

1.05 JOB CONDITIONS

A. Dust Control: Prevent spread of dust during performance of Work. Thoroughly moisten surfaces required to prevent dust nuisance to public, neighbors, and concurrent performance of other work on site.

B. On-site Burning: Will not be permitted.

C. Protection: Protect existing objects not to be removed. In event of damage, immediately make repairs and replacements necessary to approval of Architect at Contractor's expense.

1.06 HAZARDOUS MATERIAL ABATEMENT

A. During the construction of this project, if work involving hazardous material is suspected, or encountered, Contractor shall notify Owner or Owner's representative immediately and Owner, with his own forces or by separate contract is responsible for complete investigation, removal and disposition of hazard material in accordance with applicable laws and regulations.

PART 2 - PRODUCTS

2.01 BARRICADES AND FENCE MATERIALS

A. Materials required for barricades, tree protection and related fencing furnished by Contractor.

2.02 FILL MATERIAL

A. Refer to Section 31 00 10, if applicable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Notification: Notify Architect at least two full working days prior to commencing work.

B. Site Inspection:
1. Prior to work of this Section, carefully inspect entire site and objects designated to be removed or preserved.
2. Locate existing utility lines to be abandoned and determine requirements for disconnecting and capping.
3. Locate existing active utility lines which are to remain and determine requirements for their protection.

C. Clarification:
1. Drawings do not purport to show all objects existing on site.
2. Before commencing work of this Section, verify with Architect all objects to be removed and all objects to be preserved.

D. Scheduling:
1. Schedule work in a careful manner with necessary consideration for neighbors and public.

2. Avoid interference with use of, and passage to and from, adjacent buildings and facilities.

3.02 DISCONNECTION OF UTILITIES

A. Before commencing demolition or removal, and if not already accomplished, disconnect or arrange for disconnection of utility service connections, including water, gas, electricity, and telephone, to buildings to be demolished complying with regulations of utility concerned. Plug sanitary sewer lines in accordance with local requirements. Conduct operations at Contractor's expense and in manner to preserve service to areas and structures not demolished. If underground utility services disconnections are required in public thorough-fares, comply with removal and restoration of pavement requirements and other pertinent matters.

B. Preserve in operating condition active utilities bordering or traversing site designated to remain. Protect property, including, but not limited to, valve boxes, poles, guys and related appurtenances. Repair damage to active utility, due to work under contract, to satisfaction of utility concerned. Remove utility lines that are to be abandoned from building area.

3.03 STRIPPING TOPSOIL

A. Remove existing grass and overburden before excavating topsoil.

B. Prior to beginning excavation or fill, strip the topsoil to a depth of at least 6 inches or to a depth sufficient to remove all organic material and stockpile for future use.

C. In general, remove topsoil where structures are to be built, trenches dug and roads, parking lots, walks and similar improvements constructed within the areas presently covered with topsoil.

D. Store topsoil clear of the construction area.

E. Take reasonable care to prevent the topsoil from becoming mixed with subsoil or eroding.

3.04 DEMOLITION OF STRUCTURES

A. Demolish buildings and/or building elements designated for demolition, pulling out foundations and concrete slabs. Completely remove designated building components and any obstructions above ground level and down to bottom of footings below ground level. Salvageable materials become property of Contractor unless otherwise shown or specified and shall be promptly removed from site.

B. Fill holes and trenches resulting from demolition and removal, to ground surface. Rock and materials from masonry construction may be used in backfilling up to a depth of 1 foot below ground surface if sufficient fine materials are mixed therewith to fill voids. Use dirt for top 1 foot of fill, free from trash, wood, pipe and debris.

C. After clearing, perform rough grading necessary to provide complete run-off of surface water.

D. Barricade open excavations until backfilled. Do not backfill until backfill materials have been inspected and approved by Architect's representative.

E. Wet down masonry thoroughly during demolition to prevent spread of dust.

F. Leave parcel site in safe and clean condition, free from rubbish, debris, materials, and equipment.

G. When Contractor starts building demolition, excluding interior striping of salvable items including plumbing and electrical fixtures, he is to continue work during normal working days suitable to operations until demolition and site clearance is completed, unless otherwise specifically authorized by Owner.

3.05 PROTECTION AND REPAIR

A. Erect temporary barricades and fencing required to protect existing and new site construction including but not limited to new and existing walks, drives, roads, curb and gutter, etc. during construction.

B. Allow no heavy traffic on new or existing paving unless authorized in writing by Owner.

C. Contractor is responsible for restoring all existing site construction, including softscape (landscape), that is damaged during construction to new condition.

D. If it is necessary to cut or trench across any existing paving (including walks), Contractor is responsible for restoring damaged areas to new condition.

3.06 PROTECTION OF TREES TO REMAIN

A. At trees to remain, construct temporary barricade around tree at tree's approximate drip line. Provide barricades at least 3 feet high, consisting of 2 inch by 4 inch or larger posts set at least 18 inches into ground, no more than 6 feet on centers, joined at top by 1 inch by 6 inch or larger boards firmly nailed to posts.

B. Trimming of Trees: In company with Architect, ascertain limbs and roots which are to be trimmed and clearly mark them to designate approved cutting point. Cut evenly, using proper tools and skilled workmen to achieve neat severance with least possible damage to tree. Promptly coat cut area with approved pruning paint complying with manufacturer's recommendations. In case of root cuts, apply wet burlap or related protection approved by Architect, to prevent drying out.

3.07 TREE/BRUSH REMOVAL

A. Remove trees, brush and vegetation except trees which are to remain, from Project site. Material resulting from clearing becomes property of Contractor, who shall be responsible for disposal.

B. Wet down areas where required during site clearing to prevent spread of dust.

C. Blasting on Project site is not allowed as a means of tree removal.

3.08 STUMPS AND ROOTS

A. Remove completely stumps and roots from areas within building walls and 5 feet outside building walls. Remove remaining stumps and roots to clear depth of not less than 2 feet below subgrade level. Material resulting from grubbing becomes property of Contractor, to dispose of by him. Burn no material on premises.

3.09 OBSTRUCTIONS

A. Remove existing obstructions from area to be occupied by Work under this Contract unless otherwise specified herein, or specifically directed by Architect to remain.

3.10 REMOVAL OF DEBRIS AND CLEANING

A. Remove and legally dispose of rubbish and debris found on demolition area at start of the Work that resulting from demolition activities or deposited on site by others during the duration of contract. Keep project area and public right-of-way reasonably clear at all times. Upon completion of work remove temporary construction, equipment, salvaged materials, trash and debris leaving entire project area in neat condition.

END OF SECTION 02 41 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Form cast-in-place concrete required and subsequently remove forms except as otherwise specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide foreman at all times during execution of this portion of the Work, thoroughly familiar with type materials being installed, referenced standards, and requirements of this work, and who shall direct work performed under this Section.

B. Codes and Standards:
   1. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in "Recommended Practice for Concrete Formwork", publication ACI 347 of the American Concrete Institute.
   2. Where provisions of pertinent codes and standards conflict with requirements of this Section more stringent provisions govern.

PART 2 - PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Lumber: Provide form lumber in contact with exposed concrete using new material except as allowed for re-use of forms. Provide form lumber as follows, a combination thereof, or an equal approved in advance by Architect:
   1. "Plyform", class I or II, bearing label of the American Plywood Association.
   2. Southern Pine or Douglas Fir, number 2 grade, seasoned, surfaced 4 sides.

B. Form Sealers: Provide "React S" by Conspec, or approved equal.

2.02 TIES AND SPREADERS

A. Type: Type which does not leave an open hole through concrete and which permits neat and solid patching at every hole.

B. Design: Metal not less than one inch from surface at completion of concrete work.

2.03 EXPANSION JOINTS

A. Non-extruding, pre-moulded filler strips conforming to ASTM D 1751 or D 1752 and compatible with sealant material used to seal joints.

2.04 FORMED JOINTS

A. Non-staining materials; of wood, plastic, or metals, formed to be removed without spalling concrete.

2.05 KEYED JOINTS

A. KEY-LOK® by Form-A-Key Products, BoMetals QuicKey by White Cap, Muller Construction Co. or approved equal. Top of stakes set 3/8" below slab surface so when joint form is placed on stakes, painted portion of joint is finished elevation. Finish concrete to top of joint and burn in with hand trowel.

2.06 OTHER MATERIALS

A. Provide materials, not specifically described but required for completion of concrete formwork as selected by Contractor subject to advance approval of Architect.

PART 3 - EXECUTION

3.01 CONSTRUCTION OF FORMS

A. General: Construct substantial, sufficiently tight forms to prevent fins and leakage of mortar, and able to withstand deflection when filled with wet concrete.

B. Layout:
   1. Form cast-in-place concrete to shapes, sizes, lines, and dimensions required.
   2. Exercise particular care in form layout to avoid necessity for cutting of concrete after placement.
   3. Make proper provision for inserts, sleeves, pipes, openings, offsets, recesses, anchorage, blocking, and related features as required.

C. Forms for footings and related below grade concrete may be omitted when soil and workmanship permit accurate excavation to size and where omission is approved by Architect.

D. Removal of forms: Time for removing forms is subject to weather conditions after concrete is poured. Remove form work in manner to insure complete safety of structure. Do not place building materials on slabs until they are strong enough to carry the imposed load. Contractor shall decide when to remove forms and accept full responsibility for their removal.

3.02 JOINTS

A. If proposed layout of joints differs from layout shown on drawings, Contractor shall submit three (3) copies of alternate layout plan to Architect for review. Do not proceed with alternate layout of joints without written approval from Architect.

B. Provide mechanical "Keyed Kold" joint screed forms used in placing concrete slabs on grade installed to comply with manufacturer's specifications.

C. Construction Joints: Where joint is made, thoroughly clean concrete surface and remove all latence. In addition, thoroughly wet and slush vertical joints with a coat of neat cement grout immediately before placing new concrete.

D. Expansion Joints: Do not run reinforcement, corner protection angles, or related fixed metal items, embedded in or bonded into concrete continuous through expansion joints. Provide filler strips for expansion joints between slabs on grade and all joints between slabs on grade and vertical surfaces. Construct joints 1/2-inch thick and full depth of slab, unless otherwise noted.

E. Saw-cut Control Joints: In "Green" concrete the following tables will apply.
   1. Depth of cut:
      a. Soff-Cut Saw: 1" minimum
      b. Wet-Cut Saw: 1/4 slab thickness
   2. Joint spacing based upon slab thickness, UNLESS NOTED OTHERWISE:
      a. 4" slab equals 10'-0" o.c.
      b. 5" slab equals 13'-0" o.c.
      c. 6" or thicker slab equals 15'-0" o.c.

3.03 RUBBED SURFACES

A. Construct forms for exposed cast-in-place concrete with smooth exterior grade plywood or steel with joints butted tight to prevent fins and leaking. As soon as forms are stripped, rub down concrete surface with carborundum grinders using water and Portland cement as rubbing agent. Rub exposed concrete until a uniformly even surface is obtained, with no joint marks or defects showing. Do not apply neat cement or grout to concrete as painted or plastered finish coat.

3.04 JOINT-FREE SURFACES

A. No joint allowed in formed surfaces where joint-free surfaces are required. In forming for joint-free surfaces, use metal lined forms and cover form joints with form tape.

3.05 CHAMFERED CORNERS

A. Chamfer corners of rectangular concrete members formed with wood forms except where flush with adjacent concrete or masonry, or where covered with other materials.

END OF SECTION 03 10 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install reinforcement and associated items required for cast-in-place concrete.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Furnish Shop Drawings for review by Architect, on reinforcing steel including special details, bending diagrams, schedules, bar lists, placing diagrams, and accessories. In addition to provisions in General Conditions, submit reinforcing Shop Drawings prepared by or under supervision of registered professional engineer. Reproduction (in any form) of Contract Drawings are not to be used for Shop Drawings. Furnish two prints and one sepia reproducible of Shop Drawings to Architect for review. Submit related shop drawings together. Partial submittals will not be accepted.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide foreman at all times during execution of this portion of the Work, thoroughly familiar with type materials being installed, referenced standards, and requirements of this work, and who shall direct work performed under this Section.

B. Codes and Standards:
   1. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in "Manual of Standard Practice for Detailing Reinforced Concrete Structures", publication ACI 315 of the American Concrete Institute.
   2. Where provisions of pertinent codes and standards conflict with requirements of this Section more stringent provisions govern.

PART 2 - PRODUCTS

2.01 CONCRETE REINFORCEMENT

A. Concrete Reinforcement Materials: New, free from rust, and complying with following reference standards:
   1. Bars for Reinforcement: "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement", ASTM A-615, grade 60 unless otherwise shown.
   2. Wire Fabric: ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   3. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI CODE-318 except as specified.

2.02 OTHER MATERIALS

A. Provide metal accessories, including spacers, chairs, ties, and devices necessary for properly assembling, placing, spacing, and supporting reinforcement (including welded wire fabric at 2" from top of slab) in place. Provide materials, not specifically described but required for complete and proper installation of concrete reinforcement, as selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 SITE CONDITIONS

A. Inspection:
   1. Carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.
   2. Verify that concrete reinforcement may be installed to comply with pertinent codes and regulations, reviewed Shop Drawings, and original design.

B. Discrepancies:
   1. In event of discrepancy, immediately notify Architect.
   2. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 BENDING

A. General: Fabricate reinforcement to comply with reviewed Shop Drawings. Do not use bars with kinks and bends not shown on Drawings or on reviewed Shop Drawings. Do not bend and straighten steel in manner that will injure material.

B. Assembly: Tack-welding not acceptable for assembly of reinforcement without specific approval of the Structural Engineer. When permitted by Engineer all welding shall conform to reinforcing steel welding code (AWS D.12.1) of the American Welding Society.

3.03 PLACING OF REINFORCEMENT

A. Placing:
   1. Support and wire together reinforcing bars to prevent displacement by construction loads and placing of concrete. On ground and where necessary, supporting Normal Weight concrete blocks may be used. Provide at flat formwork, metal or plastic coated bar chairs and spacers. Provide galvanized, stainless steel or plastic coated accessories where concrete surface will be exposed to weather in finished structure and where rust would impair architectural finishes.
   2. Lap welded wire fabric minimum of 12" in structural slabs and minimum of 6" in slabs-on-grade. Support mesh in final position in all slabs. Lifting of mesh into final position is not permitted.
   3. Do not bend bars after embedded in concrete.

B. Cleaning Reinforcement: Remove loose, flaky rust, mill scale, mud, oil, and related coatings that will destroy and reduce bond during concrete placement.

C. Splices: Splice where shown on Drawings or reviewed Shop Drawings.

D. Concrete Reinforcement Protection: If not detailed otherwise, where concrete is deposited against ground, reinforcement shall have minimum of 3" concrete between it and the ground. If concrete surfaces after removal of forms are to be in contact with ground or exposed to weather, protect reinforcing with minimum of 2" of concrete for bars larger than No. 5 and 1-1/2" for No. 5 bars and smaller. Provide minimum 3/4" concrete covering for reinforcing in slabs and 1-1/2" minimum cover in beams at surfaces not exposed directly to ground or weather.

END OF SECTION 03 20 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Cast-in-place, reinforced concrete required. Provisions of this Section are applicable to structural concrete at building as well as to site improvement work.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Design Mix: Prior to placement of concrete, submit concrete mix designs proposed by the concrete supplier for class of concrete, including recent test results substantiating the quality of concrete produced by each mix.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen:
   1. Provide foreman at all times during execution of this portion of the Work, thoroughly trained and experienced in placing type concrete specified and who shall direct work performed under this Section.
   2. Finishing of Exposed Surfaces of Concrete: Use thoroughly trained and experienced journeyman concrete finishers.

B. Codes and Standards:
   1. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations of "Building Code Requirements for Structural Concrete", publication ACI CODE-318 of latest issue of the American Concrete Institute.
   2. American Concrete Institute, ACI PRC-302.1R-04, or most current revised issue, Guide for Concrete Floor and Slab Construction.
   3. Where provisions of pertinent codes and standards conflict with requirements of this Section more stringent provisions govern.
   4. ACI SP-66 - ACI Detailing Manual.
   5. ACI 301 - Standard Specifications for Structural Concrete.
   6. ACI SPEC-301-20: Specifications for Concrete Construction.

1.05 LABORATORY TESTING

A. All required testing will be performed by testing laboratory selected by Owner. Cost for laboratory services for concrete tests and mix designs paid by Contractor. Material for tests furnished by Contractor.

B. Contractor shall submit three (3) copies of certified laboratory test reports to Architect for review.

C. Testing Procedures:
   1. Material Testing: Laboratory to re-check at plant materials as often as necessary to produce concrete of specified strength and consistency including:
      (a) Fine aggregate.
      (b) Coarse aggregate.
      (c) Cast-in-place concrete.
   2. Concrete Slump: 6" with allowable variation of plus or minus 1 inch.
   3. Quality Control: As work progresses testing laboratory personnel shall conduct tests of concrete in accordance with following procedures:
      (a) Secure composite samples from the same batch complying with ASTM C 172.
      (b) Perform one (1) slump test for each set of strength test cylinders complying with ASTM C 143.
      (c) Make one (1) strength test (4 specimens) for each 40 cubic yards and at least one (1) set for each day's pour.
      (d) Mold four (4) strength test specimens from each sample complying with ASTM C 31 and protect and cure under standard moisture and temperature conditions in accordance with Section 7 of above ASTM method.
      (e) Test two (2) specimens at seven (7) days complying with ASTM C 39. If specimens for a particular batch test at or above required strength for that batch, it is not necessary to test the remaining specimens. Hold the remaining specimens for an additional ninety (90) days in case future testing is required. If the specimens tested at seven (7) days do not meet or exceed the desired strength requirements, the remaining two (2) specimens will be tested at twenty-eight (28) days. Average strength of two (2) specimens from each group tested is basis for acceptance or rejection of concrete. If tested strength falls below strength specified at twenty-eight (28) days, Architect has the right to order the removal and replacement of defective concrete at Contractor's expense. If Contractor wishes to obtain test cores from in-place concrete, cost of coring, testing and patching will be paid by Contractor.
   4. Flatness: Variation in flatness within a 10' area shall not exceed 1/8" +/-.

1.06 REFERENCES

A. Publications listed below form a part of this specification to extent referenced.
   1. ACI 117-10: Standard Specifications for Tolerances for Concrete Construction and Materials

2. ACI 211.1-91(R2009): Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
3. ACI 211.2-98(R2004): Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
4. ASTM B46.1-2019, Surface Texture (Surface Roughness, Waviness, and Lay).
5. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
6. ASTM C1059 - Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
7. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
8. ASTM C1895-20 Standard Test Method for determination of Mohs Scratch Hardness Tests.
9. ASTM D5767-18 Standard test Method for Instrumental Measurement of Distinctness of Image (DOI) Gloss of Coated Surfaces.
10. ASTM E1155-20 Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.
11. ASTM C260 - Standard Specification For Air-Entraining Admixtures For Concrete.
12. ASTM C33/C33M-23 - Standard Specification for Concrete Aggregates
13. PCI - Portland Cement Association - Concrete Slab Surface Defects: Causes, Prevention, Repair, ©2001 or more current publication.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: Conform to ASTM "Standard Specifications for Portland Cement", C150, Type I. Use one brand of cement. Mix shall contain at least 470 lb. of Portland Cement per cubic yard of concrete. Use 520 lb of cement if freeze thaw deicing chemicals used or required by conditions.

B. Aggregates: Conform to ASTM "Standard Specifications for Concrete Aggregates", C33. Provide aggregate of natural sand and gravel or prepared from stone or gravel, free from adherent coatings. Maximum size of pieces 1", except for footings and foundation walls which may be 1-1/2" maximum size. Use pea gravel aggregate for concrete mix used for filling voids in concrete block walls where required.

C. Water: ASTM C1602. Clean and free from injurious amounts of oils, acids, alkalis, organic materials, and deleterious substances. **Non-potable water will not be used in concrete mixing.**

D. Fly ash will NOT be allowed except at below grade applications. DO NOT USE in architecturally exposed concrete, particularly at floor conditions, including polished concrete, if applicable.

E. Air Entrainment: ASTM C260 and ASTM C494. Comply with current building code.

2.02 CONCRETE STRENGTHS

A. Cast-in-place Concrete: Designed to develop 3,500 psi minimum compressive strength at 28 days, unless noted otherwise on Structural Drawings. ***Refer to Division 32, EXTERIOR IMPROVEMENTS for strengths required for various concrete site improvements.***

2.03 GROUT

A. Non-Shrink, Non-Metallic, Flowable Grout meeting ASTM C1107/CRD C621 (structural steel grouting, base plates, anchor bolts, tuck pointing):
   1. Con-Spec CS-100
   2. W.R. Meadows Sealtight CG-86™
   3. Master® Builders Solutions MasterFlow 110AN
   4. L&M DURAGROUT™
   5. SikaGrout 212
   6. Kaufman Products SureGrout
   7. Euclid N.S. Grout
   8. Dayton Superior 1107 Advantage Grout
   9. Approved equal.

2.04 CONCRETE FLOOR SEALER

A. Furnish and apply to concrete surfaces shown on finish schedule as "Sealed Concrete", polyurethane concrete sealer:
   1. Spec Cote Urethane by Dayton Superior. Primer to be Spec Cote WB High Performance Water-Based Epoxy Coating.
   2. Approved equal.

B. Surface Preparation: Concrete floor should be sound clean and dry and free of oil, dirt, grease, paint, laitance, and the typical membrane forming curing compounds. The concrete should be at least 28 days old. Floors should be mechanically prepared i.e., shot-blast, sandblast, to result in a International Concrete Repair Institute (ICRI) Concrete Surface Profile (CSP) of between CSP #1-2, or the texture of medium grit sandpaper to ensure proper adhesion. If oils or grease are present chemical degreasers should be used to thoroughly degrease concrete before shot-blasting.

C. Minimum of two (2) applications are required.

D. Provide clear color for all applications.

2.05 CONCRETE CURING COMPOUND

A. SpecChem E-Cure® Water-Based Concrete Curing Compound; non-yellowing.
   1. Tested per CDPH Standard Method V 1.2-2017 and complies with all LEED V.4 Requirements.

2. Adhesion tested by TCNA (Tile Council) for compliance with thin-set mortar and vinyl tile adhesive. Meets the moisture retention of ASTM C 309 Type 1D, Class A & B on a hard troweled concrete surface.

2.06 UNDERSLAB DRAINAGE FILL

A. Crushed stone or washed gravel, uniformly graded from 1 inch minimum to 3/4 inch maximum size.

2.07 CONCRETE PATCH AND REPAIR

A. Provide Adhesives Technology Crackbond® JF Joint & Crack Filler, a two-component polyurea joint filler designed for heavy duty traffic, property repairs and freezer applications. It is solvent free, flexible and with its low viscosity and self-leveling design, allows for 10-15 % movement of installed joint width. It may be used in temperatures between -40 °F to 120 °F (-40 °C to 49 °C). Excellent for the filling of active cracks in concrete in exterior horizontal applications. Polyurea formulation offers long term product adhesion and stability without cracking or deterioration.

2.08 OTHER MATERIALS

A. Provide materials, not specifically described but required for complete and proper installation of cast-in-place concrete, selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 MIXING AND PLACING CONCRETE

A. Preparation: Clean equipment for transporting concrete. Remove debris, water, and ice from places to be occupied by concrete. Remove laitance and unsound material from hardened concrete before additional concrete is added.

B. Mixing: Ready-mixed concrete, mixed and delivered in accordance with following requirements only of ASTM C 94.
   1. Tolerances in Slump,
   2. Measuring Materials,
   3. Batching Plant,
   4. Mixers and Agitators,
   5. Mixing and Delivery,
   6. Use of Non-Agitating Equipment
   7. Inspection.

C. Conveying: Convey concrete from mixer to place of deposit by methods that prevent separation and loss of materials.

D. Placing:
   1. Deposit as nearly as practicable in final position to avoid segregation due to re-handling and flowing. Place at rate to assure concrete is plastic and flows readily into spaces between bars. Do not use concrete contaminated by foreign material or re-tempered concrete.
   2. When placing is started, carry a continuous operation until placement of panel or section is completed.

E. Hot Weather Concreting: Place, handle, and cure concrete complying with ACI SPEC-305.1.

F. Cold Weather Concreting: Provide adequate equipment for handling concrete materials and protecting concrete during freezing and near freezing weather. Concrete materials, reinforcements, forms, and ground in contact with concrete to be free of frost, snow, and ice. Details of approved procedures are available in ACI SPEC-306.1. Contractor to keep accurate thermometer on job where the work is proceeding.

G. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

3.02 PROTECTION OF ADJACENT SURFACES

A. Contractor responsible for any work soiled and stained by dripping cement, water, or concrete. Protect same with tarpaulin or similar devices while pouring concrete.

3.03 CONSOLIDATION

A. Consolidate concrete by vibration, spading, rodding, or forking. Work around reinforcement, embedded items and into corner of forms. Over-vibrating and use of vibrators to transport concrete within forms not allowed. When consolidating by vibration, keep spare vibrator on job site during concrete placing. Use vibrators of length to extend within 6 inches of bottom of freshly poured concrete, vibrator being raised with each succeeding pour.

3.04 CONCRETE CURING AND FINISHING

A. **Curing Period:** Cure concrete for minimum period of 7 days at a temperature above 50° F. by one of approved methods listed below. Protect fresh concrete from heavy rain, flowing water, mechanical injury and from injurious action of sun. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

B. **Potable Water Curing:** If cured with water, keep concrete wet by mechanical sprinklers or by any approved method which will keep surface continuously wet.

C. **Evaporation Retarder:** Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions prevail. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. **Curing Compounds: NO CHEMICAL CURING COMPOUNDS ALLOWED.**

E. **Waterproofing Paper or Opaque Polyethylene Film:** Conform to ASTM C 171. Cover concrete immediately following final finishing operation. Anchor securely, seal edges or apply in manner to prevent moisture escaping from concrete.

F. **Curing Blanket:** AASHTO M-182, Class II, ASTM C-171 burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

G. **Concrete Patching:** Immediately after stripping forms, examine surfaces. Patch honeycombing, defective joints, voids, tie holes, and defects before concrete is thoroughly dry. However, make no attempt to correct or fill any honeycomb spots, or any other defects until they have been examined by Architect and approval obtained as to correction to be employed. Finish of patch to match adjoining surface.

H. **Concrete Finishes (ACI 301, latest edition):**
   1. Interior General: Floor slabs, including topping slabs, to be smooth and steel troweled to hard dense surface (non-burnished), except where required to be depressed. Rough float finish depressed surface. Protect concrete floors during construction period.
   2. Exterior: Pads, Steps, Stairs, Slabs and other surfaces to receive light-medium broomed finish for non-slip surface.

3.05 FLOOR SLOPE TO DRAINS

A. Slope floors to drain outlets. Low spots where pools of water can stand on finished floors are not acceptable. Slope to drains 1/8" per lineal foot unless otherwise marked.

B. Slope floors uniformly from perimeter walls and partitions to drain outlets (unless otherwise indicated).

C. When multiple drains are shown in a room, space equally. Create dedicated area per drain outlet and slope floor uniformly from area perimeter to drain outlet (unless otherwise indicated).

END OF SECTION 03 30 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Pre-blended mortar mixes for use in indicated locations and types of masonry construction as specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 REFERENCE STANDARDS

A. ASTM International:
1. ASTM C91 - Standard Specification for Masonry Cement.
2. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C150 - Standard Specification for Portland Cement.
4. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
5. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
6. ASTM C476 - Standard Specification for Grout for Masonry
7. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
8. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
9. ASTM C1329 - Standard Specification for Mortar Cement.
10. ASTM C1384 - Standard Specification for Admixtures for Masonry Mortars.
11. ASTM E514 - Standard Test Method for Water Penetration and Leakage Through Masonry.
12. ASTM C 1357 - Standard Test Method for Evaluating Masonry Bond Strength.
13. ASTM C 1314 - Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry.
14. ASTM C 1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
15. ASTM C 1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar.
16. ASTM C 1019-20 - Standard Test Method for Sampling and Testing Grout for Masonry.

B. International Masonry Industry All-Weather Council (IMIAC):
   1. Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
   2. Recommended Practices and Guide Specification for Hot Weather Masonry Construction.

C. National Concrete Masonry Association (NCMA):
   1. NCMA TEK Bulletin #8-2A Removal of Stains from Concrete Masonry.
   2. NCMA TEK Bulletin #8-3A Control and Removal of Efflorescence.

1.04 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Samples: Submit selection and verification samples of mortar.

1.05 CLASSIFICATION OF MORTAR

A. Classification by Volume Measurements: Unless otherwise approved by Architect, conform to ASTM C 270 (or latest version), Table 1, for Cement-lime Mortar.

B. Classification by Test:
   1. Strength test, if required, determined with mortar prepared in laboratory selected by Architect or Owner, using representative materials and in proportions proposed for use. Preparation of and curing of mortar and test cubes shall conform to ASTM Specification C 270 of latest issue. Laboratory tests, if required, paid for by Contractor.
   2. Minimum Compressive Strength at End of 28 Days: Not less than that prescribed in ASTM C 270 (or latest version), Table 2, for Cement-lime Mortar.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

A. Mortar Cement & Sand Masonry Mortar: SPEC MIX® Mortar Cement & Sand Masonry Mortar is a dry pre-blended mortar mix containing mortar cement and dried masonry sand formulated for superior bond, workability and board life.
   1. Mortar Type: M (2,500 psi).
   2. Mortar Type: S (1,800 psi).
   3. Applicable Standards: ASTM C 144, ASTM C 270, ASTM C 595, ASTM C 780, ASTM C 1072, ASTM C 1093, ASTM C 1157, ASTM C 1314, ASTM C 1329, ASTM C 1384, ASTM C 1586, ASTM C 1714, ACI 530.1, IMIAC.

B. Approved Manufacturers:
   1. Pro Mix® Masonry Mortar (Types S), as manufactured by Ash Grove Packaging, 315 Phillips Road, North Little Rock, AR 72117, 1-800-548-4219. For colored mortar provide ASH GROVE® Cement Color.
   2. Solomon Colors, Inc. SGS Concentrated Mortar Colors, 800-624-0261. Color to be selected from manufacturer's complete offering.

C. Basic Requirements: Conform to ASTM C 270 for materials, aggregate, and water and for storage, measurement, and mixing. Weights per cubic foot of materials in mortar are considered as follows:

D. Portland Cement: Type I or Type II conforming to ASTM C 150.

E. Sand: Clean sharp granules, free from loam, acids, alkalies, soluble salts, clay, or organic matter, conforming to ASTM C 144.

F. Quicklime for Lime Putty: Conform to ASTM C 5 with lime slaked and putty prepared in accordance with ASTM C 270. If hydrated lime is used conform to ASTM C 207, Type S.

G. Mortar for Laying Exterior Masonry: Waterproofed with Dry Block Mortar Admixture by Grace Construction Products.

2.02 ANTI-FREEZE ADMIXTURE

A. Mortar admixture for use when temperature drops below 50 deg.F.

B. Provide Conspec Q-Set, or approved equal.

2.03 GROUT FOR MASONRY SIGNIFICANCE AND USE (ASTM C1019-20)

A. Grout used in masonry is a fluid mixture of cementitious materials and aggregate with a high water content for ease of placement.

B. During construction, grout is placed within or between absorptive masonry units. Excess water must be removed from grout specimens in order to provide compressive strength test results more nearly indicative of the grout strength in the wall. In this test method, molds are made from masonry units having the same absorption and moisture content characteristics as those being used in the construction.

C. This test method is used to either help select grout proportions by comparing test values or as a quality control test for uniformity of grout preparation during construction.

D. The physical exposure condition and curing of the grout are not exactly reproduced, but this test method does subject the grout specimens to absorption conditions similar to those experienced by grout in the wall.

1. Test results of grout specimens taken from a wall should not be compared to test results obtained with this test method.

PART 3 - EXECUTION

3.01 MORTAR MIXING

A. Mix complying with manufacturer's instructions. Mix in batches for work immediately on hand. Measure by known capacity volume using barrow, buggy, manufacturer's packages, or related containers or by using approved batching device so specified proportions are consistently maintained. Do not use material that has partially set, been re-tempered, or used, frozen, caked, or become lumpy. Mix mortar with proper water amount for minimum of 3 minutes to desired consistency in batch mixer. Use mortar of as wet a consistency as can conveniently be handled. Do not use mortar which has greatly stiffened and in which cementing material has started to set. Do not re-temper mortar.

3.02 MORTAR USES

A. **Type N Mortar:** Type N mortar is suitable for general use in exposed masonry above grade. It is recommended for use in parapet walls, chimneys and exterior walls when subject to severe exposure.

B. **Type S Mortar:** Type S mortar is recommended for use in reinforced and unreinforced masonry where higher flexural strengths than Type N are required.

C. **Type M Mortar:** Type M mortar is recommended for use in masonry in contact with earth such as foundations, retaining walls, paving, sewers and manholes, and in reinforced masonry.

D **Type O Mortar:** Type O mortar is suitable for interior use in non-loadbearing applications.

END OF SECTION 04 05 13

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install specified joint reinforcement, anchors, ties, control joints, and related masonry accessories.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 PRODUCT HANDLING

A. Protection: Protect masonry accessory materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make replacements necessary to approval of Architect and at Contractor's expense.

PART 2 - PRODUCTS

2.01 METAL ACCESSORIES

A. CMU Joint Reinforcement: HB Lox-All® Truss Joint Reinforcement 120 Truss-Mesh Standard 9 Gauge Weight Hot-Dip Galvanized in size required.

B. Non-Load Bearing Partition Anchors: Unless otherwise called for on Structural Drawings, provide mesh wall ties, galvanized 16 gage wire 1/2" square mesh, by 20" long. Width to be 3" for 4" block partitions, and 2" less than the nominal width dimension for 6", 8", 10" and 12" block partitions. Install partition anchors where concrete block abuts other walls or partitions. Mesh anchors to occur in alternate joints to miss joint reinforcing.

C. CMU Joint Reinforcement: Truss or Ladder type, high tensile strength, standard weight No. 9 steel rods in 10 ft. lengths, in appropriate width. Vertical spacing as shown on drawings.

2.02 FINISHES FOR METAL ACCESSORIES

A. Finish metal accessories according to the following requirements as set forth in ASCE6/ACI 530.1:
   1. Joint Reinforcement, Interior Wall: ASTM A641 Class 1
   2. Joint Reinforcement, wire ties or anchors,in exterior walls or interior walls exposed to moist environment: ASTM A153 Class B2
   3. Sheet metal ties or anchors completely embedded in mortar or grout: ASTM A525 Class G60
   4. Wire ties or anchors in interior walls: ASTM A641 Class 3
   5. Sheet metal ties and anchors in exterior walls or interior walls exposed to moist environment: ASTM A153

2.03 CONTROL JOINTS IN CONCRETE MASONRY UNITS

A. In addition to locations shown on drawings, locate control joints so that spacing does not exceed 1.5 times height of wall or 30'-0" o.c. for reinforced CMU or 25'-0" o.c. for non-reinforced CMU.

B. Provide preformed gaskets placed in sash grooves of concrete masonry using Dur-O-Wal D/A 2001/2025, or approved equal. Factory extrude from solid section of natural or synthetic rubber conforming to ASTM D-2000 2AA-805, with minimum curometer hardness of not less than 80 when tested in accordance with ASTM D 2240.

C. At exposed face of CMU, provide backer rod and sealant in addition to extruded sash groove control joint.

PART 3 - EXECUTION

3.01 INSTALLATION OF MASONRY ACCESSORIES

A. Install masonry accessories at proper stages of masonry construction specified in Section 04 20 00 - Unit Masonry, and as required for performance of proper masonry workmanship.

B. Apply flashing to weather barrier system prior to and/or after installing cladding anchors per weather barrier manufacturer recommendations.

END OF SECTION 04 05 23

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish labor, tools, scaffolding, and required equipment, and materials for masonry construction specified and required to provide high quality masonry workmanship.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen:
   1. For actual cutting and placing of masonry units, use skilled journeyman masons thoroughly experienced with materials and methods specified and thoroughly familiar with design requirements.
   2. Have one skilled journeyman mason present at all times during execution of work of this Section who shall personally direct and execute this portion of the Work.

1.05 SAMPLE FIELD PANELS

A. Erect a sample field panel for each of the following masonry materials required for this project:
   1. CMU: include special shapes, sills, single corner units, lintel units, solid cap units, and install a typical Control Joint at the center of the panel.
      a. Sills at interior openings may be 4" x 8" x 16" solid cap units or regular size Lintel units placed upside down to achieve flat and flush surfaces.

B. Each sample panel is to be 6' long by 4' high. Use full size units to show color, color range, texture, bond, profile of joints, and workmanship. After approval, panel will be the standard for minimum workmanship and appearance requirements. Do not remove panel until authorized by Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

A. **Materials:** Meet referenced ASTM Standards, with modifications specified herein.

B. **Lightweight Concrete Blocks (C33-1) and/or Normal Weight Concrete Blocks (C33):**
1. Use nominal 8" x 16" face, thickness required. Conform to ASTM C90 (Latest Edition), Type II. Use Type I at exterior if CMU is to be exposed to weather, for hollow loadbearing concrete masonry units and ASTM C129 (Latest Edition), Type II, for hollow non-loadbearing concrete masonry units. Cut blocks as required to form jambs, sills, and closers. Use normal weight blocks for below grade block work and at exterior block work that is exposed to weather. Lightweight block may be used at all other locations unless otherwise stated on Architectural or Structural Drawings. At Contractors expense, provide certification of ASTM C90 and C129 compliance from certified testing laboratory.
   a. All exterior concrete block to have Integral Water Repellant Masonry Unit admixture.
2. Provide standard "Sash Block" at locations where control and/or expansion joints are called for in CMU construction. Coordinate with control joint material specified in Section 04 05 23.

C. **Reinforced CMU Construction:** Conform to the provisions of ANSI A41.2 (NBS Handbook 74) and/or ACI/ASCE 530.

D. **Packaged Materials:** Provide mortar materials specified in Section 04 05 13. Provide masonry accessories specified in Section 04 05 23. Deliver and store packaged materials, including cement, in original packages plainly marked with brand and maker's name. Materials in broken containers and in packages showing water marks and evidence of damage will be wholly rejected. **Mortar color shall be selected by the architect.** MATCH EXISTING COLORED MORTAR.

E. **Concrete Fill:** Fill voids in concrete block where required with structural masonry grout complying with ASTM C476 and ASTM C404. Refer to NCMA TEK 09-04A and TEK 3-2A. Grout may be Fine or Course depending on use. Do not use mortar for this purpose.

2.02 MASONRY CLEANERS

A. Products approved for use are Sure Klean® 600 Detergent.
1. 101 Lime Solvent for dark-colored brick and tile surfaces.
2. Sure Klean® Vana Trol® acidic cleaner for new masonry surfaces.
3. EaCo Chem NMD 80 buffered acid-based new masonry cleaner.

B. Provide products by ProSoCo®, Enviro Klean® Safety Klean, alternative to traditional acidic compounds.

C. Consult masonry manufacturer and ProSoCo Technical Service prior to applying any cleaner. Some cleaners are not suited for use on certain masonry units and may cause damage that will be repaired or replaced at Contractor's expense.

2.03 FLEXIBLE FLASHING

A. Provide **Rhino-Bond** 40 mil peel and stick no-drool flashing by Wire-Bond®, or approved equal. Use termination bar for securing flashing to structure where required at surface-mount substrates incompatible with membrane adhesive.

PART 3 - EXECUTION

3.01 LAYING CONCRETE BLOCK

A. Lay blocks straight, plumb, and in perfect alignment. Protect concrete blocks from weather by covering during storage and after laying. Before using blocks, dry them to moisture content of approximately the average air-dry condition to which finished walls will be exposed. Take care to keep mortar off face surface of exposed blocks. At end of job, clean exposed block walls. Where necessary to fit around wall switches and openings, cut blocks to neat line with power saw. Refer to drawings for spacing and type of reinforcement and anchors required.

B. Lay block in 1/2 bond, with mortar finished using a round tool giving concave joints. Nominal thickness of all joints is 3/8" and uniform.

3.02 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within the tolerances specified.

B. Maximum variation from plumb:
1. In 10 feet: 1/4 inch
2. In 20 feet: 3/8 inch
3. In 40 feet or more: 1/2 inch

C. Maximum variation from level:
1. In any bay or up to 20 feet: 1/4 inch
2. In 40 feet or more: 1/2 inch

D. Maximum variation from linear building lines:
1. In any bay or up to 20 feet: 1/2 inch
2. In 40 feet or more: 3/4 inch

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
1. Minus 1/4 inch
2. Plus 1/2 inch

F. Maximum variation in prepared opening dimensions:
   1. Accurate to minus 0 inch
   2. Plus 1/4 inch

3.03 PROTECTION OF OPEN CAVITY WALLS DURING CONSTRUCTION

A. Protection:
   1. All exposed openings in CMU construction shall be protected during the erection process to prevent water from entering, especially at the tops of walls, and settling within interior cavities causing leaching and other damaging occurrences resulting from capillary action. Secure temporary waterproof membranes at the end of each day's work to prevent rain and snow from entering the cores and cavities. Planks laid on the wall are not considered adequate cover.
   2. Refer to the Portland Cement Association publication "Recommended Practices for Laying Concrete Block".

3.04 BUILT-IN ITEMS

A. Build in wood blocks, strips, wedges, frames, loose lintels, miscellaneous iron and other items furnished by other subcontractors and which may be required for properly securing their work.

3.05 FREEZING WEATHER

A. Do not lay masonry when outside air temperature is below 40 degrees F., unless suitable means are provided to heat masonry materials and to protect completed work from freezing for at least 48 hours.

3.06 CLEANING PREMISES

A. Mason Contractor: Remove rubbish and building materials left over from operations under his charge, whenever directed by General Constructor. Premises must be left clear and clean. When buildings are completed, completely remove mortar droppings.

3.07 BOND BEAMS

A. Reinforce bond beams as required and fill with 3,000 psi. minimum compressive 28-day strength concrete, unless shown otherwise on structural drawings. Do not use masonry mortar for this purpose.

3.08 POINTING AND CLEANING

A. Cut out defective mortar joints. Refill solidly with mortar and tool to match adjacent work.

B. On completion clean exposed masonry, removing foreign material, excess mortar and stains. Apply cleaning solution to sample area of approximately 20 square feet at an inconspicuous location approved by Architect. Use cleaning solution specially manufactured for this purpose, applying in accordance with manufacturer's directions. Drench masonry with clean water before applying solution, and after cleaning, rinse with clean water to remove all traces of solution. Protect materials adjacent to masonry from contact with cleaning solution.

C. High Pressure Water Cleaning: **This method of cleaning will not be allowed on masonry surfaces unless approved by architect and masonry manufacturer.** High pressure water is to be used to saturate the masonry before cleaning takes place and may be used to rinse away cleaning solution and foreign particles after cleaning is complete. Allow mortar to cure for a minimum of seven (7) days before subjecting it to high pressure cleaning. After consulting with Architect and manufacturer for cleaning recommendations, test clean a sample panel of all the materials selected for the work. Apply water at a pressure ranging from 300-500 psi (not to exceed 800 psi). Provide a flow rate of water between 3 and 6 gallons per minute through a "Fan" type, stainless steel tip dispersing a 25° to 50° fan spray. Do not use less than 15° fan spray tip. Application of acidic cleaning compounds through the high pressure system will not be allowed. Do not apply sealer until masonry is completely dry and cleaning has been reviewed by Architect.

END OF SECTION 04 20 00

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PART 1 - GENERAL

1.01 WORK INCLUDED

A. Degreasing surfaces

B. Surface profiling

C. Washing and rinsing

D. Steel, including shop-fabricated bollards, in or near direct contact with grade or not protected by substantial roof or canopy overhang.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. Publications
   1. American Galvanizers Association (AGA):
      Inspection of Products Hot-Dip Galvanized After Fabrication
      Duplex Systems: Painting Over Hot-Dip Galvanized Steel

   2. Elsevier, van Eijnsbergen, J.F.H., New York, 1994: *Duplex Systems - Hot-Dip Galvanizing Plus Painting Wet Storage Stain*

B. Reference Standards
   1. American Society for Testing and Materials (ASTM):
      A 123/123M Zinc (Hot-Dip Galavanized) Coatings on Iron and Steel Products

      A 153/153M Zinc (Hot-Dip Galavanized) Coatings on Iron and Steel Products

A 780 Repair of Damaged Hot-Dip Galvanized Coatings

D 6386 Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

D 7803 Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Powder Coating

1.05 QUALITY ASSURANCE

A. Coating Applicator: Company specializing in painting or Hot-Dip Galvanizing after fabrication.

1.06 DELIVERY, STORAGE AND HANDLING

A. Load and store galvanized articles in accordance with accepted industry standards.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SURFACE PREPARERS

A. Members of the American Galvanizers Association or equal, such as painting contractors, approved by the design professional.

2.02 HOT-DIP GALVANIZED MATERIALS

A. Material for surface preparation suitable for painting is required to be Hot-Dip galvanized as described in ASTM A123/A 123M and A 153/A 153M. Hot-Dip galvanized articles and fabrications may be newly galvanized, partially galvanized or completely weathered.

2.03 HOT-DIP GALVANIZING REQUIREMENTS

A. Hot-Dip galvanizing practices shall be in accordance with the applicable portions of ASTM A123/A 123M or A 153/A 153M.

B. Water quenching or chromate quenching conversion coating should be avoided as these processes interfere with paint adhesion and surface preparation.

PART 3 - EXECUTION

3.01 SURFACE SMOOTHING

The following process should only be used if high spots of zinc are visible on the parts to be painted.

A. Zinc high spots, such as a metal drip line, should be removed by cleaning with hand or power tools as described in SSPC Surface Preparation Specification 2 or 3. The zinc should be removed until it is level with the surrounding area, taking care that the base coating is not removed by the cleaning methods.

B. After cleaning, the surface shall be inspected for conformance to the required zinc thickness in accordance with ASTM A123/A 123M or A 153/A 153M utilizing a magnetic-field-type thickness instrument in accordance with ASTM E 376. Any item falling below the required zinc thickness, before or after removal of any high spots, shall be repaired in accordance with ASTM A 780.

3.02 AQUEOUS ALKALINE CLEANING

This surface cleaning is required for all galvanized steel parts, except for those that have been galvanized less than 24 hours.

A. An alkaline solution, pH in the range of 11 to 12 but not greater than 13, can be used to remove traces of oil, grease or dirt.

B. This solution can be applied through immersion in a tank filled with the solution, sprayed on, or brushed on with a soft bristle brush, usually nylon and not steel or copper.

C. When dipping or spraying, the solution works best in the temperature range from 60 to 85 C (140 to 185F).

D. After cleaning, rinse thoroughly in hot water under pressure. Allow to dry completely before proceeding.

3.03 SOLVENT CLEANING

This is an alternative to Section 3.02.

A. Typical cleaning solvents, such as mineral spirits or high-flash naptha, can be used to remove oil and grease. The procedure to be used is as specified in SSPC Surface Preparation Specification 1.

B. Proper rags or brushes should be used to wipe galvanized parts. Small parts may be dipped or cleaned in ultrasonic baths of solvents.

C. After cleaning, rinse thoroughly in hot water or water under pressure. Allow to dry completely before proceeding.

3.04 HAND OR POWER-TOOL CLEANING

The following process should be used only if there is visible evidence of wet storage stain on the galvanized surface.

A. Hand or power-tool cleaning may be used to clean light deposits of zinc reaction by-products, such as wet storage stain, as specified in SSPC Surface Preparation Specification 2 or 3.

3.05 SWEEP BLASTING

This process is required for all galvanized parts, except those that have been exposed to the environment for more than one year.

A. Abrasive sweep or brush blasting which uses a rapid nozzle movement will roughen the galvanized surface profile. The abrasive material must be chosen with care to provide a stripping action without remove excess zinc layers. Follow the procedures detailed in ASTM D 6386 for abrasive sweep blasting.

B. Following abrasive blast cleaning, surfaces should be blown down with clean compressed air.

3.06 ZINC PHOSPHATE TREATMENT

This is an alternate process for Section 3.05.

A. This conversion-coating process consists of treating the newly galvanized zinc surface with an acidic zinc phosphate solution containing oxidizing agents and other salts for accelerating the conversion action. Follow the procedures detailed in ASTM D 6386 for zinc phosphate treatment.

B. After 3 to 6 minutes, the surface should be washed with clean water and allowed to completely dry before application of the paint system.

3.07 WASH PRIMER TREATMENT

This is an alternate process for Section 3.05.

A. This process involves the use of metal conditioner to neutralize surface oxides and hydroxides and to etch the surface. Follow the procedures detailed in ASTM D 6386 for wash primer treatment.

B. For drying time prior to top coating, follow the manufacturer’s instructions. This wash-primer treatment may be better suited to certain types of paint systems.

3.08 ACRYLIC PASSIVATION/PRETREATMENT

This is an alternate process for Section 3.05.

A. The passivation/pretreatment process consists of applying an acidic acrylic solution to the newly galvanized surface and then allowing it to dry, forming a thin film coating. Follow procedures detailed in ASTM D 6386 for acrylic passivation/pretreatment.

B. Painting is possible any time during a period of four months after application as long as the surface is free of visible zinc oxides or zinc hydroxides.

3.09 REPAIR OF DAMAGED COATING

The following process should be used only if there is visible damage to the zinc coating.

A. The maximum area to be repaired is defined in accordance with ASTM A 123/A 123 M Section 6.2, current edition.
   1. The maximum area to be repaired in the field shall be determined in advance by mutual agreement between parties.

B. Repair areas damaged by welding, flame cutting or during handling, transport or erection, by one of the approved methods in accordance with ASTM A 780 whenever damage exceeds 3/16" in width. Minimum thickness requirements for the repair are those described in ASTM A 123/A 123M Section 6.2 current edition.

END OF SECTION 05 05 16

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and erect structural steel framing and accessories.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Shop Drawings:
      a. Submit shop drawings showing complete details for the fabrication and erection of members. Manufacturer's professional engineer shall be licensed in the state where proposed project is located.
      b. Submit details, schedules, procedures, and diagrams showing the sequence of erection.
      c. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.
      d. Submit shop drawings for review prior to starting any work. Work performed prior to shop drawing review is at contractors risk.
      e. **Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. CAD files will be available to the Contractor or Sub-contractors with a release letter or per AIA Document C106™ - 2013 Digital Data Licensing Agreement, after the award of a Contract.**

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. American Iron and Steel Institute (AISI)
   1. "Specification for the Design of Cold-Formed Steel Structural Members" .
   2. "Cold-Formed Steel Design Manual" (Latest).

B. American National Standards Institute (ANSI)

1. ANSI A58.1 - "Roof, Wind and Snow Loads".

C. American Society for Testing and Materials (ASTM):
   1. ASTM A446 - Steel Sheet, Zinc-coated (galvanized) by Hot-Dip Process, Structural (Physical) Quality.
   2. ASTM A570 Hot-Rolled Carbon Steel Sheet & Strip, Structural Quality.
   3. ASTM A525 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
   4. ASTM A611 - "Standard Specification for Steel, Cold-Rolled Sheet, Carbon, Structural."
   5. ASTM C955 - "Standard Specification for Load Bearing Steel Studs, Runners (Track), Bracing, and Bridging."

D. American Welding Society (AWS):
   1. AWS D1.1 - "Structural Welding Code" and D1.3 - "Specifications for Welding Sheet Steel in Structures."
   2. AWS - “Standard Qualification Procedure”.

E. Metal Lath/Steel Framing Association (ML/SFA) - "Lightweight Steel Framing Systems Manual," Latest Edition.

F. American Society of Civil Engineers (ASCE) - “Minimum Design Loads for Buildings and Other Structures: Chapter 6 - Wind Loads”.

1.05 PERFORMANCE REQUIREMENTS

A. Contractor is responsible for design, fabrication and erection of steel stud framing to meet the requirements of the latest adopted Local Code.

B. Compute all structural properties in accordance with AISI "Specifications for the Design of Cold Formed Steel Structural Members."

C. Provide weldments as required in accordance with American Welding Society (AWS) AWSD1.3 "Structural Welding Code - Sheet Steel".

1.06 SYSTEM DESCRIPTION

A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the ML/SFA Lightweight Steel Framing Systems Manual.
   1. Design shall use the superimposed design loads specified in the "Design Criteria" section of the "Structural General Notes" in the contract drawings.
   2. Design shall be based upon information shown on the drawings and specified herein.
   3. Maximum deflection of exterior wall systems shall not exceed L/600 for Masonry Veneer and L/360 for EIFS Veneer.

4. 18 gage studs are the minimum allowed for framing that supports masonry.

B. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load resistance. All connections (member to member, and member to structure) shall be designed and detailed.

C. Qualification of Field Welding: Qualify welding process and welding operators in accordance with AWS "Standard Qualification Procedure".

1.07 DELIVERY AND STORAGE

A. Protect steel studs from rusting and damage.

B. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

C. Store off the ground in a dry, ventilated space.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products manufactured by one of the following manufacturers or by a current member of the Steel Stud Manufacturers Association.
1. Consolidated Systems Incorporated, 4900 Hungerford Road, Memphis, Tennessee 38118, Phone (901) 365-0226
2. Dietrich Industries Inc., 500 Grant Street, Suite 226, Pittsburgh, Pennsylvania 15219, Phone (412) 281-2805
3. Marino\WARE, 400 Metuchen Road, South Plainfield, NJ, 800-627-4661.
4. Telling Industries, 1400 Southwire Road, Osceola, AR 72370, 888-711-3124.
5. The Steel Network, Inc., Telephone: 888-474-4876.
6. Approved equal.

2.02 GENERAL REQUIREMENTS

A. Provide type, size, gauge and physical properties as described by the manufacturer's load and height tables and in accordance with the current local building code. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

B. Structural calculations specifically related to this project and performed by the manufacturer's professional engineer will indicate depths, gages and spacings of studs required to meet deflection and load bearing requirements. Professional engineer shall be licensed in the state where proposed project is located.

C. At all instances where radius steel stud and drywall construction is shown on drawings it is intended that the radius be smooth not faceted. Contractor is required to provide smooth face radius by whatever means necessary.

D. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

2.03 MATERIALS

A. All structural members shall be formed from steel conforming to ASTM A653-94.

B. All structural members shall be zinc coated in accordance with ASTM A924, G-60 coating.

C. System Components: With each type of steel stud required, utilize runners (tracks), shoes, clips, angles, ties, fasteners, door jamb reinforcers, bridging and accessories for the applications indicated, as needed to product a complete metal stud system in both vertical and horizontal planes for interior and exterior conditions.

2.04 FABRICATION

A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.

C. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted. Cut framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until fastened.

D. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.01 ERECTION

A. Anchor tracks securely to supporting structure to transfer imposed loads.

B. Provide complete, uniform and level bearing support for bottom track at each bearing stud location.

C. At intersection and abutting track joints, anchor abutting track pieces securely to a common structural element, or splice them together.

D. Splices in axial loaded studs not permitted.

E. Framed Wall Openings: Include properly designed header and multiple (or heavier) studs at each edge of opening, to compensate for those removed.

F. Diagonal Bracing: Install at wall locations used as "shear walls" for frame stability and to resist wind and lateral loads. Anchor bracing securely for uplift and horizontal shear. Position additional stud(s) as required to resist the vertical component.

G. General:

1. Install continuous tracks sized to match studs. Align tracks accurately to the lay-out at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, nor 16" o.c. for other types of attachment. Provide fasteners at corners and end of tracks.
2. Set studs plumb, except as needed for diagonal bracing or required for no-plumb walls or warped surfaces and similar requirements.
3. Where stud system abuts structural columns or walls anchor ends of stiffeners to support structure.
4. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support handrails, bumper guards, wall mounted door stops, fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.
5. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
6. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
7. Frame both sides of expansion and control joints, as shown for the wall system, with a separate stud and do not bridge and joint with components of the stud system.
8. **Provide framing, including cross-bracing, for attachment of exterior soffit components able to resist upward wind forces, where applicable. Refer to Section 07 42 93 - Soffit Panels.**

END OF SECTION 05 40 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install miscellaneous metal items required and specified. Provide miscellaneous bolts, anchors, supports, braces, and connections necessary for completion of Work.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Submit Shop Drawings on miscellaneous metal items for review by Architect, prior to fabrication. Include type, grade, class of metal and sizes, details of fabrication, methods of assembling, connections to supporting construction, reinforcement, and location of hardware.
      a. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract nor will they be made available to the Contractor or Sub-contractors after the award of a Contract. Only conventional, paper reproductions of such information will be made available to parties listed above.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. Specifications for the Design, Fabrication and Erection of Structural Steel for Building

B. American National Standards Institute (ANSI):
   1. ANSI A14.3, "Ladders, Fixed, Safety Requirements."

C. American Society for Testing and Materials (ASTM):
   1. ASTM A36, "Structural Steel."
   2. ASTM A53, "Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe."
   3. ASTM A123, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
   4. ASTM A153, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
   5. ASTM A307, "Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."
   6. ASTM A446, "Specification for Sheet Steel, Zinc-Coated by the Hot-Dip Process."
   7. ASTM A500, "Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes."
   8. ASTM A568, "Specification for General Requirements for Steel, Carbon and High-Strength Low Alloy Hot-Rolled Sheet and Cold Rolled Sheet."
   9. ASTM A627, "Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications.
   10. ASTM A780, "Practice for Repair of Damaged Hot-Dipped Galvanized Coatings."
   11. ASTM B221, "Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube."

D. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code.

E. Steel Structures Painting Council Specification (SSPC):
   1. Steel Structures Painting Manual.

1.05 QUALITY ASSURANCE

A. Qualifications of Welders: Use certified welders and the shielded arc process for welding performed in connection with work of this Section.

B. Codes and Standards: In addition to complying with pertinent codes and regulations, comply with:
   1. "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.
   2. "Code for Welding in Building Construction" of the American Welding Society.

C. Conflicting Requirements: In event of conflict between pertinent codes and regulations, requirements of the referenced standards, and these specifications, provisions of more stringent govern.

D. Design, engineer, fabricate and install handrails and railing systems to comply with requirements of ASTM E985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935. Conform to the current version of the IBC.

E. Handrails, guardrails, and their supports to be designed for 50 lbs per linear foot, applied in any direction at the top of the top rail, and a concentrated load of 200 lb applied in any direction at any location along the top of the rail. The uniform load and concentrated loads are not to be applied simultaneously. Other components, including guardrail infill and bottom rails, are to be designed for 100 lbs acting on a projected area of 1 square foot, including the open space between components. The effects of this load are not to be combined with the load on the top rail.

F. ASTM E 985 - For railing - related definitions and structural performance criteria.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel plates, angles, and other structural shapes shall conform to ASTM A36.

B. Steel pipe shall conform to ASTM A53, Grade B, Schedule 40.

C. Galvanized steel pipe and tube shall conform to ASTM A53.

D. Steel Tubing shall conform to ASTM A500.

E. Sheet Steel, Galvanized: ASTM A446.

F. Sheet and Strip Steel, Hot Rolled: ASTM A568.

G. Extruded Aluminum: ASTM B221.

H. Anchors and Fasteners for Aluminum: Stainless steel.

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Anchors
   1. Threaded Type Concrete Inserts: Galvanized malleable iron or cast steel capable of receiving 3/4 inch diameter machine bolts.
   2. Slotted Type Concrete Inserts: Welded box type fabricated with minimum 1/8 inch thick galvanized pressed steel plate with slot to receive 3/4 inch diameter square head bolt and knockout cover.
   3. Expansion Shield for Masonry Anchorage: FS FF-2-325.
   4. Toggle Bolts: FS FF-B-588.

K. Fasteners
   1. Bolts, Nuts and Washers for Exterior Locations: ASTM A307, galvanized in accordance with ASTM A153.
   2. Bolts, Nuts and Washers for Interior Locations: ASTM A307, Grade A, regular hexagon head.

3. Bolts, Round Head: ANSI B-18.5
4. Wood Screws, Flat Head Carbon Steel: ANSI B-18.6.1.
5. Plain Washers, Helical Spring Type Carbon Steel: FS FF-W-84.

2.02 FABRICATION

A. Fabricate steel items according to approved shop drawings and to applicable portions of AISC Specifications. Conceal welds where possible; grind exposed welds smooth and flush with adjacent finished surface. Ease exposed edges to small uniform radius.

B. Pre-assemble products in shop to greatest extent possible. Disassemble units to extent necessary for shipping and handling. Clearly mark units for re-assemble and installation.

C. For exposed to view fabrications, use materials which are smooth and free of surface blemishes including pitting, seams marks, roller marks, roller trade names and roughness. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coating.

D. Fabricate items with joints tightly fitted and secured.

E. Fit and shop assemble in largest practical sections for delivery to Project site.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.

G. Make exposed joints butt tight, flush and hairline.

H. Fabricate anchorage and related components of same material and finish as metal fabrication, unless indicated otherwise.

2.03 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.04 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels for equal bearing of one inch per foot of clear span but not less than 8 inches bearing at each side of openings, unless otherwise indicated.

D. All steel lintels shall be coated with a zinc rich primer.

2.05 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inch x 8 inches long.

2.06 SHELF AND RELIEVING ANGLES

A. Fabricate shelf and relieving angles from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4 inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.

B. Galvanize shelf angles to be installed on exterior concrete framing.

2.07 FINISHES, GENERAL

A. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

C. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
   1. ASTM A153 for galvanizing iron and steel hardware.
   2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

D. Preparation for Shop Priming: Prepare un-coated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Interiors (SSPC Zone 1A): SSPC-SP3 “Power Tool Cleaning”:
   2. Apply shop primer to un-coated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 “Paint Application Specification No. 1” for shop painting.
   3. Lead Free, Zinc Rich Alkyd Primer - Air Dry: Manufacturer's standard.

2.08 PIPE GUARDS

A. Furnish and install 6" diameter galvanized-for-painting steel upright pipe guards filled with concrete. Refer to drawings for reinforced concrete footing detail.
   1. Provide Schedule 40 Pipe Bollard Cap for 6" diameter as manufactured by Reliance Foundry Co., 1-888-735-5680. Install as recommended.

2.09 ACCESS DOORS

A. Manufacturer: Milcor Limited Partnership, 1150 North Cable Road, Lima, OH 45805, 1-800-528-1411, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

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

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

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

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.02 CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 05 50 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Worked covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances for execution, installation and completion of all work specified herein and/or shown on the drawings.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Design, engineer, fabricate and install handrails and railing systems to comply with requirements of ASTM E985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935. Conform to the current version of the IBC.

B. Structural design, fabrication and assembly shall be in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design stairs to support a live load of 100 pounds per square foot.

D. Handrails, guardrails, and their supports to be designed for 50 lbs per linear foot, applied in any direction at the top of the top rail, and a concentrated load of 200 lb applied in any direction at any location along the top of the rail. The uniform load and concentrated loads are not to be applied simultaneously. Other components, including guardrail infill and bottom rails, are to be designed for 100 lbs acting on a projected area of 1 square foot, including the open space between components. The effects of this load are not to be combined with the load on the top rail.

E. ASTM E985-00(2006) - Standard Specification For Permanent Metal Railing Systems And Rails For Buildings.

F. Calculations: Provide professionally prepared calculations and certification of performance of this work, signed and sealed by a Professional Engineer registered in the state where the work is located. Perform structural design of the stair including supports and railing for the metal stair frame. Indicate how Design Criteria as specified have been incorporated into the design.

G. Conform to the following current Accessibility Standards:
   1. ICC/ANSI-A117.1 - Standard for Accessible and Usable Buildings and Facilities.
   2. Americans with Disability Act Standards for Accessible Design (ADASAD).
   3. Architectural Barriers Act (ABA).

1.05 MOCKUP

A. General: Mockup components for railing, to include handrail, shall be full size, using the same materials as those to be used in the actual Work, including details and methods of construction.

B. Fabricate interior railing mockup in accordance with approved Shop Drawings.

C. Railing Mockup may be part of final assembly but contractor has the option of removing and proper disposal.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Pipe: ASTM A53, Standard Weight.
   1. Shop primed for interior applications
   2. ASTM A123 and ASTM A153 After-Fabrication Galvanizing for exterior applications.
   3. G90 Continuous Galvanizing (Coil to Coil) for exterior painted applications.

B. Rectangular Tubing: ASTM A500, Grade B or have equal yield, ultimate, and weldability properties.

C. Steel Grating: Fed. Spec. RR-G-661, Type I or II, with serrated surfaces. Shop primed for interior applications, zinc coated for exterior applications.

D. Sheet Steel: ASTM A366.

E. Structural Steel: ASTM A36.

F. Steel Floor Plate: ASTM 786.

G. Steel Decking: Form from steel conforming to ASTM A446, with properties conforming to AISI Specification for the Design of Cold-Formed Steel Structural Members. Shop primed for interior applications, zinc coated for exterior applications.

H. Steel Plate: ASTM A570.

I. Iron Castings: ASTM A48, Class 30.

J. Malleable Iron Castings: ASTM A47.

K. Stainless Steel Pipe & Fittings: Type 304 (18-8), Ornamental Grade, No.4 Satin Finish.

2.02 FABRICATION GENERAL

A. Verify dimensions on site prior to shop fabrication.

B. Fit and shop assemble components in largest practical sizes, for delivery to site and installation.

C. Supply components required for secure anchorage of stairs, handrails and railings.

D. Fully weld joints. Grind exposed welds smooth and flush with adjacent surfaces.

E. Make exposed butt joints tight, flush, and hairline.

F. Accurately form components required for anchorage of members to each other and to building structure.

G. Welding:
1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
2. Where possible, locate welds on unexposed side.
3. Grind exposed welds smooth and true to contour of welded member. Remove welding splatter.

2.03 SHOP PRIMER

A. Lead free, alkyd primer: Manufacturer's standard.

2.04 CLOSED RISER STAIRS

A. Provide treads, risers, platforms, stringers, headers and other supporting members.

B. Fabricate pans for treads from sheet steel, and fabricate pans for platforms from steel decking. Form risers to have sanitary cove.

C. Fabricate stringers, headers, and other supporting members from structural steel.

2.05 STEEL RAILING SYSTEM

A. Rails and Posts: Sizes and shapes as indicated.

B. Mounting on Concrete Floor: Steel sleeves, sized to receive railing post with 1/4 inch clearance.

C. Mounting on Masonry or Concrete Walls: Provide brackets with anchors.

D. Mounting on Stud Walls: Provide brackets and anchor plates, pre-drilled to receive bolts.

E. Splice Connectors: Steel threaded collars.

F. Handrail Returns: Handrail extensions must return to a wall, itself or to the walking surface. Note: Leave a gap between a wall return and the wall, and verify approval by the local Authority Having Jurisdiction (AHJ) before fabrication and installation.

G. Rail Extensions: Extensions shall return to a wall, guard, or the landing surface or continue to another stair run.
   1. Extensions of the handrail is required by the ADA and building codes.
   2. Ramps: Handrails extend horizontally above the landing for 12 inches minimum beyond the top and bottom of the ramp runs.
   3. Stairs, top extension: Handrails extend horizontally above the landing for 12 inches minimum beginning directly above first riser nosing.
   4. Stairs, bottom extension: Handrails extend at the slope of the stair flight for a horizontal distance equal to one tread depth beyond the last riser nosing.

2.06 STANDARD ALLOY STEEL PIPE RAILINGS

A. Provide ADA and code compliant cast ductile iron wall mount handrail brackets in standard finish, No. 1766 round saddle with one mounting hole as manufactured by Wagner Collaborative Metal Works, 888-243-6914, or approved equal.

PART 3 - EXECUTION

3.01 PREPARATION

A. Supply items to be embedded in masonry or concrete or placed in partitions with setting templates and erection drawings to approximate sections.

3.02 STAIR INSTALLATION

A. Provide hangers and struts required to support the loads imposed.

B. Perform job site welding and bolting as specified for shop fabrication.

C. Set stairs and other members in position and secure to structure as shown. Install stairs plumb, level and true to line.

3.03 RAILING INSTALLATION

A. Provide standard terminal fittings at ends of posts and rails.

B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.

C. Install adhesive anchors per current Code strength design methodology for structural concrete and ACI standard ACI 355.4-11, requiring test requirements and assessment criteria to include, but not be limited by the following:
1. Concrete depth
2. Edge distance
3. Anchor embedment
4. Mounting plate sizes
5. Reinforcement

D. Set rails horizontal or parallel to rake of stairs to within 1/8-inch in 12 feet.

E. Set posts plumb and aligned to within 1/8-inch in 12 feet.

3.04 STAIR NOSING INSTALLATION

A. Installation instructions for poured concrete.
1. Pour concrete to form stairs. Schedule pours to allow safety stair treads to be installed quickly before initial set occurs. Make sure to have required number of safety treads before pouring concrete.

   WARNING: THE USE OF VERY LARGE AGGREGATE OR CONCRETE WITH A VERY LOW SLUMP WILL MAKE INSTALLATION OF THE STAIR NOSING DIFFICULT.
2. Select one of the stair nosing components and place nosing, with attached anchors, into fresh concrete. Ensure that front edge of nosing is flush with riser form or at the dimension indicated on the architectural drawings.
3. Gently work nosing into the concrete until back edge of nosing is level with finished edge of tread. Work nosing into concrete until it is level, plumb, flush with tread, and at the proper elevation. To provide a stable installation ensure that stair nosing anchors are securely set in concrete and that concrete completely surrounds nosing components.

4. Any voids left between the underside of the metal stair nosing and the substrate will allow flexing of the stair nosing itself. **It is vital that the installer tamp down the stair nosing to totally seat it into the substrate and fully rest upon any riser return such as in pan-filled steps.** This action will prevent the occurrence of hollows and voids which can lead to flexing and cantilevering of the nosing.
5. Repeat the procedures given in Step 2 and Step 3 above until all stair nosing are installed and properly positioned.
6. After concrete has taken its initial set, remove riser forms and finish concrete riser flush to stair nosing front or as otherwise specified. This is important to ensure that the riser has a clean finish.
7. Stairway must be closed for a minimum of twenty-four (24) hours or until concrete has cured.

3.05 FIELD PRIME PAINTING

A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.

END OF SECTION 05 55 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Includes: Provide rough carpentry, and installation of items specified in other Sections, normally installed by carpenters. Section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Shop Drawings: Show fabrication and installation details for trusses.
1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

1.04 QUALITY ASSURANCE

A. Material Grading: Identify hardboard, particleboard, lumber, and plywood by affixing grademark, stamp, or related identifying marks indicating material grades, rules or standards under which they are produced, and complying with rule or standard under which the material is produced. Use certified inspection agency certified by the Board of Review, American Lumber Standards Committee, to grade lumber species. In lieu of piece grade-marking, a certificate of inspection from an agency certified by the Board of Review, American Lumber Standards Committee may be furnished for precut lumber. Applicable grading rules are as follows:

1. Douglas Fir, White Fir, and Cedar: "Standard Grading and Dressing Rules for West Coast Lumber" as published by the West Coast Lumber Inspection Bureau.
2. Ponderosa and Western White Pine: "Grading Rules for Western Lumber", published by the Western Wood Products Association.
3. Southern Yellow Pine: "Standard Grading Rules for Southern Pine Lumber" as published by the Southern Pine Inspection Bureau.
4. Redwood: "Standard Specifications for Grades of California Redwood Lumber" as published by Redwood Inspection Service.

B. Plywood: Conform to U. S. Product Standard PS 1 issued by the National Bureau of Standards. Stamp or brand each standard size panel to show type and grade of panel. When used structurally, plywood to meet performance standards for its type as described in Product Standard PS 1 for Douglas Fir plywood. Furnish material identified as to species, grade, and glue type by an approved agency or independent testing laboratory with appropriate affixed grade-marks on each panel. Provide in addition to above requirements, exterior type plywood for permanently exposed plywood in outdoor applications.

C. Qualifications of Workmen: Provide sufficient skilled workmen and carpenter foreman present at all times during execution of this portion of the Work, thoroughly familiar with type construction involved, materials and techniques specified.

1.05 PRODUCT HANDLING

A. Protection:
1. Store materials to ensure proper ventilation and drainage. Protect against damage and weather.
2. Deliver materials to job site and store, in safe area, out of the way of traffic, and shored off ground surface.
3. Identify framing lumber as to grades and store grades separately.
4. Protect metal products with adequate weatherproof outer wrappings.
5. Use extreme care in off-loading lumber to prevent damage, splitting, and breaking materials.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect at Contractor's expense.

PART 2 - PRODUCTS

2.01 LUMBER

A. Provide lumber for structural carpentry using following species provided grade for each is not lower than minimum shown:

1.	Pine, Southern Yellow - SPIB Rules (KD)	No. 2 Common
2.	Fir, Douglas - WCLIB Rules	Standard
3.	Fir, White - WCLIB Rules	Standard
4.	Pine, Western White - WWPA Rules	Standard

5. Redwood - RIS Rules — Construction Heart
6. Cedar, Western Red, & Incense - WCLIB Rules — Standard

B. Lumber (except where otherwise noted): Surfaced 4 sides unless, in addition to being dressed, it has been notched, ship-lapped, or patterned.

C. Lumber Dimensions: Are nominal.

D. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
1. Design Loads: As indicated.
2. Maximum Deflection under Design Loads:
   a. Roof Trusses: Vertical deflection of 1/360 of span.

E. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

F. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.02 FIRE-RETARDANT AND PRESERVATIVE TREATED LUMBER

A. Manufacturers: Provide wood treatment by or under license from Chemical Specialties, Inc., One Woodlawn Green, Suite 250, 200 E. Woodlawn Road, Charlotte, NC 28217. ASD. Tel: (800) 421-8661, or approved equal by one of the following companies:
1. Osmose, Inc., 1016 Everee Ln., Griffin, GA 30224
2. Arch Wood Protection, Inc., 1955 Lake Park Dr., Ste. 250, Smyrna, GA 30080
3. Hoover Treated Wood Products, Inc., 154 Wire Rd., Thomson, GA 3082

B. Fasteners and Connectors: For treated wood and where wood is in ground contact, subject to high relative humidity, or exposed to weather, provide steel fasteners with hot-dip galvanized coating per ASTM A153/A153M; provide steel connectors with hot-dip galvanized coating per ASTM A653, Class G185 sheet with 1.85 ounces of zinc coating per square foot.

C. Wood Preservative Treatment:
1. ACQ Preserve.
   a. Use 0.25 lb/cu ft (4.0 kg/cu m) retention.
   b. Kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood.
   c. Treat wood in the following locations:
      1) In contact with roofing, flashing, or waterproofing.
      2) In contact with masonry or concrete.
      3) Within 18 inches (450 mm) of grade.
      4) Exposed to weather.
      5) Other locations indicated.

D. Fire-Retardant Treatment:
   1. Lumber: Comply with AWPA C20 .
   2. Plywood: Comply with AWPA C2 7, Type A.
   3. Surface Burning Characteristics: UL FRS rating; flame spread and smoke developed ratings of 25 or less in a test of 30 minutes' duration.
   4. Treatment: D-Blaze®.

2.03 PLYWOOD

A. Plywood (not otherwise specified or noted on the Drawings): Douglas Fir or Southern Yellow Pine panels, C-D grade for concealed applications and A-C grade for exposed applications, meeting U.S. Product Standard PS 1.

2.04 HARDWARE

A. Provide rough hardware required for proper installation of carpentry work. Furnish hot-dipped galvanized, nails, spikes, screws, bolts, ply clips and similar items using proper types and ample sizes to fasten and hold the various members securely in place.

B. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.

C. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

2.05 METAL CONNECTOR PLATES

A. Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.
   1. Use for interior locations unless otherwise indicated.

C. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
   1. Use for wood-preservative-treated lumber and where indicated.

D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316, and not less than 0.035 inch thick.
   1. Use for exterior locations and where indicated.

2.06 BLOCKING

A. Provide solid wood blocking system capable of sustaining loads as listed within these documents, including drawings. Do not cut or bend metal studs, or cut wood studs, to achieve flush fit to face of studs. Blocking is to span between vertical studs and be fire resistant where applicable. Verify with architect any condition or loading requirement not listed. 2x solid blocking or two layers of 5/8" or 3/4" plywood, depending on required loads and clearances, may be used at contractor option. Coordinate any electrical and audio visual components, including back-boxes and conduit, with respective contractors.
   1. Attach blocking between studs for support of surface mounted items.
      a. Plumbing fixtures.
      b. Toilet partitions.
      c. Wall cabinets.
      d. Toilet accessories
      e. Hardware.
      f. Architectural woodwork.
      g. Grab bars.
      h. Handrails and railings.
      i. Signage.
      j. Other items requiring backing for attachment.

2.07 OTHER MATERIALS

A. Provide materials, not specifically described but required for a complete and proper installation using new material, suitable for the intended use, and subject to approval of Architect.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Carpentry: Produce joints true, tight, and well nailed. Lay out, install and fit wood framing, furring, stripping, and blocking as required by conditions encountered.

B. All Work: Plumb, level, and brace with sufficient nails, spikes, and bolts required to ensure secure attachment and rigidity.

C. Any piece of work or carpentry material with defects that prevent it from serving its intended purpose satisfactorily, including crooked, warped, bowed, or otherwise defective material, even if within the limits of grade specified, will be rejected. Replace with an acceptable piece.

3.02 TEMPORARY ENCLOSURES AND PROTECTION

A. Provide temporary enclosures at door, window, and related openings in exterior walls, as necessitated by weather and adverse conditions. Maintain enclosures in good repair and remove when no longer needed. Protect door and window frames.

3.03 STUD WALLS AND PARTITIONS

A. Sole Plates: Single 2" thick members for walls and partitions.

B. Studs (unless otherwise called for): 2 x 4's spaced 16" maximum o.c., doubled at sides and heads of openings, tripled at corners and placed to provide end nailing for sheathing. Toenail studs to sole plates with two 8d nails on each face side of each stud. Lay out studs so one occurs at each joint in plywood paneling and gypsum board.

C. Top Plates: Double 2" thick members for walls and partitions.

D. Provide plates of same width as studs to form continuous horizontal ties. Provide suitable splice plates at ends of sole plates, securely nailed in place. Nail lower members of top plates to studs and corner posts with two 16d nails at each stud and post. Nail upper and lower members of top plates together with 10d nails spaced 16" o.c.. Use two 10d nails at ends of upper members, and arranged so no joint in an upper member occurs over joint in lower member. Provide trusses and lintels over openings in walls and bearing partitions. Splices in plates not permitted over openings where a plate forms part of lintel.

E. Provide one row of horizontal blocking between studs, near mid-height of wall. Furnish blocking of same width as studs.

F. Provide additional blocking for anchorage of wall or ceiling mounted items as follows:
   1. Attach blocking between studs for support of surface mounted items.
      a. Plumbing fixtures.
      b. Toilet partitions.
      c. Wall cabinets.
      d. Toilet accessories
      e. Hardware.
      f. Architectural woodwork.
      g. Grab bars.
      h. Handrails and railings.
      i. Signage.
      j. Other items requiring backing for attachment.
      k. DO NOT impede attic ventilation over the entire roof area.

G. Anchor plates and sills of interior partitions to concrete slab with "Ramset", or approved equal, power-driven drive pins. Use No. 3330 drive pins. Set drive pins not less than 2" from edge of concrete. Spacing of drive pins not to exceed 4 feet on centers with drive pins at ends of all sections of plate.

3.04 PLYWOOD INSTALLATION

A. Roof Sheathing: Apply with surface grain at right angles to supports. Support end joints of sheets on bearings and stagger with alternate courses in line. Provide edge blocking or suitable edge support. Fasten plywood in place with 8d nails spaced 6" o.c. at edge and end supports and 12" o.c. at intermediate supports. Provide hold-down clips as required.

B. Wall Sheathing: Apply with surface grain parallel to supports. Support end joints of sheets on bearings and stagger with alternate courses in line. Provide edge blocking or suitable edge support. Fasten shear panels in place with 10d common nail at 6" o.c. at edge and end supports and 12" o.c. at intermediate supports. Fasten shear panels to cold-formed steel with #8 TEK screws at 6" o.c. at edges and end supports, and at 12" o.c. at intermediate supports.

END OF SECTION 06 10 00

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PART 1 - GENERAL

1.01 SUMMARY

A. Extent of gypsum sheathing is shown on the drawings and described in this section.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Gypsum Association publications:
   1. GA-254-2017: Fire-Resistant Gypsum Sheathing
   2. GA-600-2018: Fire Resistance and Sound Control Manual

B. ASTM Standards:
   1. C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   2. C11 - Terminology Relating to Gypsum and Related Building Materials and Systems
   3. C22 - Specification for Gypsum
   4. C473 - Test Methods for Physical Testing of Gypsum Panel Products
   5. C645 - Specification for Nonstructural Steel Framing Members
   6. C1264 - Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products
   7. D3273 - Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
   8. E119 - Test Methods for Fire Tests of Building Construction and Materials

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver gypsum sheathing with factory identification of brand and grade. Protect from damage and direct exposure to severe weather. Store on leveled supports off the ground.

PART 2-PRODUCTS

2.01 MATERIALS

A. Gypsum Sheathing:
   1. Manufacturer:
      a. Dens-Glass® Gold by Georgia Pacific Corporation.
      b. GlasRoc® by Certainteed.
      c. Gold Bond® Brand by National Gypsum Company
         1) Gold Bond® eXP® Sheathing, Gold Bond® eXP® Fire-Shield® Sheathing
      d. Green Glass® by Temple-Inland
      e. Securock® Brand by USG
   2. Provide 4'-0" x 8'-0" x 1/2" thick, Fabricate sheathing with fiberglass mat facing on both sides and conforming to ASTM C1177/C1177M and ASTM C1396/C1396M for core requirements. Provide sheathing classed as noncombustible when tested by ASTM E136 with Flame Spread and Smoke Developed rating of 0 when tested by ASTM E84.

B. Fasteners: Except as otherwise indicated, provide 1", Type S-12, bugle-head cadmium plated steel or stainless steel gypsum board screws for machine installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's instructions and industry standards for the installation of gypsum sheathing.

B. Horizontal Installation: Install wide panels horizontally with end joints on supports and staggered 2 support spacings where possible, but not less than one support spacing or 12". Fasten at each support with screws (spaced approximately 8" o.c.) set back 3/8" minimum from edges.

C. Cut boards at penetrations, edges and other obstructions of the work; fit tight against abutting work, except provide 3/8" setback where non-loadbearing work abuts structural elements at head and jambs.

D. Do not bridge building expansion joints with gypsum sheathing; cut and space edges to match spacing of structural support elements.

END OF SECTION 06 16 43

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install millwork, shelving, ornamental wood items, hardware and accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Shop Drawings: Submit **newly prepared** architectural woodwork Shop Drawings for review by Architect prior to start of fabrication. **Do not duplicate Architect's construction drawings.** Indicate on shop drawings, dimensions, species, matching of panels, profiles of moldings, assembly details, applied finish, surfacing, built-in hardware, and necessary connections to other trades.
      a. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract nor will they be made available to the Contractor or Sub-contractors after the award of a Contract. Only conventional, paper reproductions of such information will be made available to parties listed above.
   2. Brochures: Submit manufacturer's descriptive literature on specialty items not manufactured by the architectural woodworker, as requested by Architect.
   3. Samples: Submit finished samples of each wood species to receive transparent finish.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Standards:
   1. "Quality Standards" of the Architectural Woodwork Institute (AWI) are referenced in this specification, however, where more stringent requirements are specified, the more stringent shall govern. Any reference to Premium, Custom or Economy in this specification is as defined in latest edition of the AWI "Quality Standards" and as modified in this specification.

2. Provide Custom grade for any item not given a specific quality grade as defined in latest edition of the AWI "Quality Standards."

B. Competence: Approved woodwork manufacturer, regularly engaged and well experienced in manufacture of fixtures and wood trim and finish of monumental building type, having reputation for doing satisfactory work on time and successfully completing comparable work. Architect reserves the right to approve woodwork manufacturer selected to furnish woodwork.

1.05 FIELD DIMENSIONS

A. Woodwork manufacturer is responsible for details and dimensions not controlled by job conditions. Show on Shop Drawings all required field measurements beyond his control. General Contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

1.06 PRODUCT HANDLING

A. Protection: Protect architectural woodwork before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

PART 2 - PRODUCTS

2.01 MILLWORK

A. Fabricate according to AWI Quality Standards for "Custom" Grade, Flush Overlay type.

B. Hardware: Install cabinet hardware furnished under this Section of these Specifications.

C. Edge Banding: Provide solid wood as shown on drawings. **IRONED ON TAPE EDGE BANDING WILL NOT BE ACCEPTED.**

D. Drawer Construction: Drawers are to be four sided, solid wood, drawer box type. **NO PANEL PRODUCTS WILL BE ALLOWED.** Head screw from the inside of the drawer box and install pulls through the drawer box.
1. Approved Alternate: Blum METABOX steel drawer system, 800-438-6788, as an acceptable product.

2.02 HIGH PRESSURE LAMINATED PLASTIC SURFACES

A. Provide finish surfaces using products from one of the following High Pressure Laminate (HPL) manufacturers, or an equal approved by Architect, in colors and patterns selected by Architect from manufacturer's standard line, in satin finish General Purpose grade:

1. Wilsonart LLC, "Wilsonart" designer colors
2. Nevamar Corporation, "Nevamar" designer colors
3. Formica Corporation, "Formica" designer colors

B. Fabricate to AWI Quality Standards for "Custom" Grade.

C. Adhesive: Type I, complying with CS 35.

2.03 HIGH PRESSURE LAMINATED PLASTIC MILLWORK

A. Fabricate according to AWI Quality Standards for "Custom" Grade, Flush Overlay type, for High Pressure Laminate (HPL) and/or Thermally Fused Laminate (TFL) with MDF or particle board (PB) finish on all surfaces.

B. Provide finish for all surfaces, inside and out, using product from one of the following high pressure plastic laminate manufacturers, or an equal approved by Architect, in colors and patterns selected by Architect from standard range of colors and patterns of approved manufacturer, in satin finish General Purpose grade:
1. Ralph Wilson Plastics, "Wilsonart" designer colors
2. Formica Corporation, "Formica" designer colors
3. Nevamar Corporation, "Nevamar" designer colors

C. Adhesive: Type I, complying with CS 35.

D. Install thermally fused **through-color coordinated** PVC edge banding on all drawer and door edges as provided by Charter Industries, 800-538-9088, or approved equal.
a. 3mm edging at counter tops, drawers, doors, and splashes.
b. 1mm edging at cabinet boxes, exposed shelving, and concealed shelving.

2.04 LOW PRESSURE LAMINATED PLASTIC MILLWORK MELAMINE

A. Fabricate according to AWI Quality Standards for "Custom" Grade, Flush Overlay type, for Thermally Fused Melamine (TFM) Laminated finish on **interior** of doors, drawers, sides, and interior shelves **only**.

B. Install thermally fused **through-color coordinated** PVC edge banding on all drawer and door edges as provided by Charter Industries, 800-538-9088, or approved equal.
a. 3mm edging at counter tops, drawers, doors, and splashes.
b. 1mm edging at cabinet boxes, exposed shelving, and concealed shelving.

2.05 PANELWORK

A. Fabricate according to AWI Quality Standards for "Custom" Grade. Book match panels.

2.06 SHELVING

A. Fabricate according to AWI Quality Standards for "Custom" Grade.

2.07 WOOD DOOR FRAMES

A. Provide Custom Quality, rotary cut, paint grade Birch, Maple, or Gum lumber and trim material for wood door frames requiring painted finish.

B. Provide Premium Quality, Rift-sawn, OR Plain-sliced, Red Oak OR Premium Quality, Rotary-cut, "Natural" Yellow Birch lumber and trim material for wood door frames requiring stained finish.

2.08 HARDWARE

A. Cabinet Doors: **(All pulls shall be ADA compliant)**
   1. 1 Pair Hinges: Bright Nickel Plated Steel, Medium-Duty, concealed style with a minimum 110 degree opening capability with three-dimensional adjustment and automatic closing as manufactured by SALICE or approved equal. Provide Clip Mounting Plate where required.
   2. 1 Pull: Hafele 101.20.729 Brushed Satin Nickel 3-3/4 Inch Center to Center Bar Cabinet Pull.
   3. 1 Cam Lock, where required, masterkeyed and keyed alike in groups as directed by Architect. Provide Cam Locks for 20% of cabinet doors equal to Medeco Cabinet Locks or as indicated on the drawings.
   4. Provide self-adhesive rubber silencers at each corner of the leading edge of cabinet doors.
   5. Provide Stanley #35 catch on all doors to comply with seismic requirements.

B. Cabinet Drawers:
   1. 1 Pair Drawer Slides: KV® Tru-Trac TT100 ball-bearing type (Length as required) at face-frame or frame-less construction. Provide heavy duty, full extension drawer slides at file drawers and all drawers over 7" deep.
   2. 1 Pull: Hafele 101.20.729 Brushed Satin Nickel 3-3/4 Inch Center to Center Bar Cabinet Pull.
   3. 1 Cam Lock, where required, masterkeyed and keyed alike in groups as directed by Architect. Provide Cam Locks for 20% of cabinet drawers UON.

C. Adjustable Cabinet Shelf Supports: Millwork subcontractor to install in-line 5mm bore holes with Knape & Vogt 332 ANO Shelf Support clips where indicated or required.
   1. Approved equal: Handy Button Shelf Spoon for 5mm holes, 5/16" Pin Length, Nickel finish, Item Number: THB6144.

D. Adjustable Shelves: Millwork subcontractor to install Knape & Vogt Heavy-Duty 233/255 Series Recessed Pilaster Standards and Support Clips where indicated or required.

E. Grommets: Provide grommets where shown on millwork drawings by Doug Mockett & Co., P.O. Box 3333, Manhattan Beach, California 90266, 213-318-2491, or approved equal. Color to be selected by Architect from manufacturers standard line. Exact locations to be verified with Architect before installation.

1. Provide TG Flip-Top® Series: 2 inch hole plastic grommets in plastic laminated countertops only.
2. Provide MFG1/A-Metal Flex Grommets: 2-11/16 inch overall, 3-3/8 inch cutout in solid surface or quartz surface countertops.

F. **Waste | Recycle Space Organizers:** Provide Salice America 19-1/2" High components for bottom mount with adjustable door mount bracket for direct pull-out:
1. 21" Wide x 19-5/8" Deep, Part No. QPAM21235CR for 24" Wide millwork Module for two-35 quart container (double) capacity each.

2.09 COUNTER SUPPORT BRACKETS

A. **EHV Vanity Support Bracket:** Provide Model No. EH-1818 surface-mounted ADA-compliant Vanity Support Bracket as manufactured by Rakks, 800-826-6006, where indicated on drawings. Install according to manufacturer's published recommendations. Verify that required blocking is installed correctly.

B. **Installation on CMU or concrete walls (if applicable):** Use masonry drill bits for Heavy Duty Brackets. Drill into the location of the first screw hole marks. This process will cause some concrete dust to collect around the holes; brush or blow this away before continuing. If using concrete anchors, drive these into the hole first, then place and align each shelving bracket. Finish by drilling the appropriate screws into the anchors and then through the shelving material itself for optimum support. Do not overdrive with power driven drills. Hand tightening is recommended as well as coated (Tapcon) screws.

2.10 INSTITUTIONAL GRADE CABINET LOCKS

A. All cabinet door, drawer, and sliding door locks shall be easily re-keyable such as manufactured by **Olympus Lock, Inc.** All locks will provide a set screw cylinder release system (US Patent 4,899,563) or speed-release cylinder removal system (US Patent 5,121,619) so easy access to the cylinder and cylinder housing can be gained by facility or locksmith personnel for servicing and re-keying. Only a similar patented system that provides working top slides for easy access to top springs and pins is acceptable. No crimping on top slides will be considered. Cylinder spacers will be provided to allow flush fit of lock cylinders on outside of cabinet material. All cam lock cylinders to include a working top slide mechanism and retainer staple to permit easy re-keying and maintenance of lock. All cam locks will have a 1 inch face diameter and include an anti-rotation plate to trap the hex nut and prevent the lock from twisting in the hole. All cam locks to be field reversible such that one straight and one offset cam will provide all locking positions. All locks will provide functionality such that the Keyway will remain in the vertical position regardless of installation as a door or drawer. Finishes will be similar to BHMA standards for US3, US4, US26D and US10B. No painted finishes will be acceptable.

B. MANUFACTURER: Olympus Lock, Inc., Lynnwood, WA, www.olympuslock.com
Contact: Tel.: (206) 362-3290, Email: info@olympuslock.com.

2.11 OTHER MATERIALS

A. Provide materials, not specifically described but required for complete and proper installation of architectural woodwork, selected by Contractor subject to approval by Architect.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate millwork, ornamental wood, and countertops to comply with reviewed Shop Drawings and referenced standards.

3.02 UNDER-COUNTER AND BUILT-IN ITEMS COORDINATION

A. Prior to fabrication, verify exact location of specified and Owner Furnished under-counter and built-in items. Verify dimensions of appliances and equipment to be installed within the millwork. Notify Architect immediately of any dimensional discrepancies that would interfere with installation of under-counter or built-in items.

3.03 INSTALLATION

A. Install architectural woodwork true, square, plumb, level, and firmly anchored for long life under heavy use.

B. Install standing and running trim with minimum number of joints. Use full-length pieces, from maximum length of lumber available, to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners and comply with Quality Standards for joinery. Butt joints, except as detailed, are not acceptable.

C. Paneling: Anchor paneling to supporting substrate with concealed panel hanger clips and by blind nailing on backup strips, splined connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.

D. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

3.04 FINAL INSPECTION

A. General: Prior to final inspection and acceptance by Architect, completely check each installed item and adjust for proper operation.

B. Compliance:
   1. Owner reserves right to request and pay for inspection by representative of the Architectural Woodwork Institute to determine that work of this Section has been performed to comply with referenced standards.

2. In event above inspection determines architectural woodwork, or any part of it does not comply with referenced standards, contractor pays all costs for initial inspection and all subsequently required re-inspections. Immediately remove non-complying items, and immediately replace them with items complying to referenced standards of these specifications, at Contractor's expense.

END OF SECTION 06 40 00

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PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent and location of polymer fabrications is indicated on the drawings.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Product Data:
1. Submit product data for each specified product. Include manufacturer's technical data sheets and published instruction instructions.
2. Submit Material Safety Data Sheets (MSDS) for adhesives and sealants.

D. Shop Drawings:
1. Submit fully dimensioned shop drawings showing countertop **[and window sill]** layouts, joinery, terminating conditions, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.

E. Samples:
1. Submit selection and verification samples for each color, pattern, and finish required.

F. Quality Assurance Submittals:
1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.
2. Warranty: Specimen copy of specified warranty.

G. Maintenance Data: Submit manufacturer's published maintenance manual with closeout submittals.

1.04 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines for Buildings and Facilities.

B. Adhesives, Sealants, and Sealant Primers:
   1. SCAQMD (South Coast Air Quality Management District) Rule 1168.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator Qualifications: Documented experience in fabricating solid surfacing countertops similar in scope and complexity to this Project. Currently certified by the manufacturer as an acceptable fabricator.
   2. Installer Qualifications: Documented installation experience for projects similar in scope and complexity to this Project, and currently certified by the manufacturer as an acceptable installer.

B. Allowable tolerances:
   1. Variation in component size: 1/8".
   2. Location of openings: 1/8" from indicated location.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect units during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

1.07 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide products of one of the following manufacturers:
   1. Corian® surfaces from the DuPont company
   2. Wilsonart® (basis-of-design).
   3. Approved equal.

2.02 SOLID POLYMER FABRICATIONS

A. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.

B. Table tops: 1/2" thick solid polymer material, adhesively joined with inconspicuous seams; edge details as indicated on Drawings.

C. Countertops with sinks: 1/2" thick countertop of solid polymer material; edge details as indicated on Drawings, complete with Drop-In Single Bowl Sink. Provide counter complete with backsplash of size shown. Refer to plumbing drawings for sink model selection.

D. Color(s) to be selected by Architect from manufacturer's standard line.

E. References:
1. DuPont™ Corian® Solid Surface Product Fabrication - Directional Aesthetics (K-26833).
2. DuPont™ Corian® Solid Surface Fabrication/Installation Fundamentals - Edge Details and Build-ups (K-25293).
3. DuPont™ Corian® Solid Surface Fabrication/Installation Fundamentals - Backsplashes (K-25294).
4. DuPont™ Corian® Solid Surface Fabrication/Installation Fundamentals - Thermoforming (K-25297).

2.03 ACCESSORY PRODUCTS

A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

B. Sealant: Manufacturer's standard mildew-resistant, FDA recognized silicone sealant in color to be selected by Architect from manufacturer's standard line.

C. Bowl mounting hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount bowls.

2.04 FABRICATION

A. For warranty coverage, fabricator/installer shall be approved by solid polymer manufacturer.

B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.

C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2" wide reinforcing strip of solid polymer material under each joint.

D. Provide holes and cutouts for plumbing and accessories as indicated on the drawings.

E. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

F. Finish: All surfaces shall have uniform finish.
   1. Matte, with a gloss rating of 5 - 20.

G. Provide permanently attached thermo-formed 1/2" radius coved back splashes specified and install per industry standards. End splashes shall be provided loose for installation at the job site after horizontal surfaces, to which they are to be attached, have been installed. Comply with forming data from manufacturer.
   1. Construct matching molds of plywood to form component shape.
   2. Form pieces to shape prior to seaming and joining.
   3. Cut pieces larger than finished dimensions. Sand edges. Remove all nicks and scratches.
   4. Heat entire component uniformly prior to forming.
   5. Prevent blistering, whitening and cracking of solid polymer material during forming.

H. Thermoforming: Comply with forming data from manufacturer.
   1. Construct matching molds of plywood to form component shape.
   2. Form pieces to shape prior to seaming and joining.
   3. Cut pieces larger than finished dimensions. Sand edges. Remove all nicks and scratches.
   4. Heat entire component uniformly prior to forming.
   5. Prevent blistering, whitening and cracking of solid polymer material during forming.

I. Provide permanently attached thermo-formed coved back splashes specified and install per industry standards. End splashes shall be provided loose for installation at the job site after horizontal surfaces, to which they are to be attached, have been installed.

J. Cove Back Splashes: Fabricate 1/2" radius cove at intersection of counters and back splashes. Form back splashes using 1/2" solid polymer material.

PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine the substrates and conditions under which polymer fabrications are to be installed and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 JOB MOCK-UP

A. Prior to final approval of shop drawings, erect one full size mock-up of each component at project site for architect review.

B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from project site.

C. Approved mock-ups shall remain as part of finished work.

3.03 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings and product installation details.

B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

C. Adhere bowls to countertops using manufacturer recommended adhesives and color-matched silicone sealant.

D. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

E. Make plumbing connections to sinks in accordance with Division 15, Mechanical.

F. Protect surfaces from damage until Date of Substantial Completion. Replace damaged work that cannot be repaired to architect's satisfaction.

G. Fabricator/Installer is to provide a commercial care and maintenance video, review maintenance procedures and warranty details with the Owner upon completion of project.

END OF SECTION 06 61 16

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install insulation and related items specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 PRODUCT HANDLING

A. Protection:
   1. Deliver materials to job site and store in safe dry place with labels intact and legible at time of installation.
   2. Protect building insulation materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

1.05 REFERENCES

A. Concealed Installations: Flame Spread rating of not more than 75 and a smoke developed rating of not more than 450 when tested in accordance with ASTM E84.

B. Exposed Installations: Flame Spread rating of not more than 25 and a smoke developed rating of not more than 450 when tested in accordance with ASTM E84.

PART 2 - PRODUCTS

2.01 RIGID PERIMETER INSULATION BOARD

A. Where indicated as "Perimeter Insulation" at turn-down slab transitions, provide 2" thick Stryrofoam™ Brand Square Edge Extruded Polystyrene (XPS) Foam Insulation Shiplap, Owens Corning® FOAMULAR® 250, or approved equal. Insulation Minimum R-Value is to meet ASHRAE 90.1-2022 for heated Slab-On-Grade Floors of R-15 for 24 inches.
   1. Sopra-XPS by Soprema.US, 800-356-3521.
   2. Dupont™ Styrofoam™ Brand Cavitymate™ Ultra Extruded Polystyrene Insulation.
   3. Kingspan GreenGuard® Type IV XPS Insulation Board.

B. Installation is to be per manufacturer's published recommendations.

2.02 ACOUSTICAL INSULATION

A. In partitions, provide un-faced Owens-Corning Pink Next Gen™ Fiberglas™ Sound Attenuation Batts (SAB) or approved equal complying with ASTM C 665, Type I and ASTM E 136. Flame spread rating shall not exceed 25 and smoke developed shall not exceed 50 when tested complying with ASTM E 84. Approved equal manufacturers:
   1. Certainteed **Noise**Reducer™ Sound Attenuation and Acoustical Ceiling Batts.
   2. Knauf Insulation EcoBatt® Insulation with ECOSE® Technology.
   3. Johns Manville Unfaced or ComfortTherm® Batts and Rolls.
   4. ROCKWOOL Safe'n'Sound® Fire & Soundproof Insulation available in 3" and 6" thicknesses. Mineral wool batt insulation conforms to ASTM C167.

2.03 FIRE RESISTIVE JOINT SYSTEMS IN RATED ASSEMBLIES

A. Thermafiber Safing Insulation - Type SAF

2.04 FIRE STOPPING OF THROUGH PENETRATIONS IN RATED ASSEMBLIES

A. Thermafiber Safing Insulation - Type SAF

2.05 OTHER MATERIALS

A. Provide materials including fasteners and retainers, not specifically described but required for complete and proper installation of building insulation, selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 INSTALLING ACOUSTICAL BATT INSULATION

A. Install the batts: Push the insulation into place between the studs. Hold the batts in place by applying pressure instead of using staples like with wood studs. Ensure proper placement: Pull the insulation to the front of the stud to eliminate any space between the insulation and the stud flange.

3.03 INSTALLING OTHER INSULATION

A. Install materials not specifically set forth above in strict accordance with manufacturer's instructions.

END OF SECTION 07 21 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Thermal insulation and moisture control system for metal buildings for the following applications:
   1. Roofs, with OSHA Compliant, leading-edge fall protection. Refer to Section 07 41 13 - Metal Roof Panels.
   2. Walls. Refer to Section 07 42 13 - Metal Wall Panels.
   3. Pre-Engineered Metal Buildings. Refer to Section 13 34 19 - Metal Building Systems.

B. Construction Manager shall verify which trade will be responsible for the installation of Thermal Space Blocks, including the order of placement.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Product Data: Provide manufacturer's data for each of the following, including:
   1. Roof installation instructions.
   2. Wall installation instructions.
   3. Product data sheet.
   4. Design consideration guide.
   5. Recycle content certification for fiberglass insulation products - minimum 50% recycled content for all fiberglass insulation materials.

D. Shop Drawings: Provide shop drawings that indicate the following:
   1. Liner fabric layout.
   2. Insulation layout and cut list.
   3. Customer and project information.

1.04 REFERENCES

A. American Society for Testing of Materials (ASTM):

1. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.
2. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
3. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
4. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure A).
5. ASTM E 2178 - Standard Test Method for Air Permeance of Metal Buildings.

B. North American Insulation Manufacturers Association (NAIMA):
1. NAIMA 202-96(R) (Rev. 2000) STANDARD For Flexible Fiberglass Insulation to be Laminated for Use in Metal Buildings.

C. National Fire Protection Association (NFPA):
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories (UL):
1. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.05 DESIGN REQUIREMENTS

A. Insulation R-Value of R-30 or U Factor of 0.037 for installed roof system.

B. Insulation R-Value of R-25 or U Factor of 0.059 for installed wall system.

C. The installed roof and wall systems shall provide a continuous vapor barrier.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Companies shall be familiar with the installation practices associated with banded liner systems.

B. Bay Insulation shall approve all materials used in the SkyLiner® Insulation System. Contact Bay Insulation for specific materials approved for use with the SkyLiner® Insulation System.
1. Substitution of any original components will nullify compliance with OSHA standards for fall protection.

1.07 SAFETY PRECAUTIONS

A. Installation contractor must have a site-specific safety plan and comply with all OSHA applicable local rules and regulations when installing this system.

B. Workers must use OSHA required fall protection when installing the banding and fabric system at heights (see OSHA regulations at 29 CFR 1926, Subpart M).

C. The SkyLiner® Insulation System meets:

1. OSHA 29 CFR 1926.502(c)(4)(i) - Except as provided in paragraph (c)(4)(ii) of this section, safety nets and safety net installations shall be drop-tested at the jobsite after initial installation and before being used as a fall protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place. The drop test shall consist of a 400-pound (180 kg) bag of sand 30" ± 2" (76 cm ± 5 cm) in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not less than 42" (1.1 m) above that level.
2. OSHA 29 CFR 1926.502(i)(2) - All other covers shall be capable of supporting, without failure, at least twice the weight of employees, equipment and materials that may be imposed on the cover at any one time.
3. OSHA 29 CFR 1926.754(e)(3) - covering roof and floor openings.
4. OSHA 29 CFR 1926.754(e)(3)(i) - Covers for roof and floor openings shall be capable of supporting, without failure, twice the weight of the employees, equipment and materials that may be imposed on the cover at any one time.

D. Banding has sharp edges. Cut proof gloves should be worn when handling.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products indoors or in a dry, covered area.

B. Do not open products until ready to use.

C. Protect products from potential construction site damage.

D. Use care when opening products as pallets may shift during shipment.

E. Banding has sharp edges. Wear cut proof gloves when handling.

F. Wear safety glasses when unpacking materials.

1.09 PROJECT CONDITIONS

A. For best results, do not install this system outside of the temperature, humidity, ventilation, and environmental limits recommended by the manufacturer. Products should be kept covered and dry at temperatures less than 100°F prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Bay Insulation Systems, Inc., Green Bay, WI, 54311; www.bayinsulation.com

2.02 MATERIALS

A. The SkyLiner® System consists of the following materials:
   1. Unfaced light density fiberglass metal building insulation in one of the following product categories:
      a. Metal Building Insulation.
         1) Complies with ASTM C991 Type 1.
         2) Complies with NAIMA 202-96-REV 2000.
         3) Flame Spread Index <25 and Smoke Developed Index <50 when tested in accordance with ASTM E84, NFPA 255 and UL 723.
         4) Certified by SCS Global Services to contain a minimum of 65% recycled glass content, 18% pre-consumer and 47% post-consumer.
         5) Thermal Resistance: Available R-Values = R10, R11, R13, R16, R19, R25 or R30.
         6) Unfaced.
         7) GREENGUARD Indoor Air Quality Certified®.
         8) GREENGUARD Gold Certified.
      b. Metal Building Filler Blanket Insulation.
         1) Flame Spread Index <25 and Smoke Developed Index <50 when tested in accordance with ASTM E 84, NFPA 255 and UL 723.
         2) Certified by SCS Global Services to contain a minimum of 65% recycled glass content, 18% pre-consumer and 47% post-consumer.
         3) Thermal Resistance: Available R-Values = R10, R11, R13, R16, R19, R25 or R30.
         4) Unfaced.
         5) GREENGUARD Indoor Air Quality Certified®.
         6) GREENGUARD Gold Certified.
   2. Fabric liner facing/vapor barrier composed of woven high-density polyethylene coated on both sides with polyethylene. Complies with the following:
      a. ASTM C1136, Types I through VI.
         1) Type 1-IV exception for dimensional stability (value is <2.0%).
      b. Perm rating: 0.02 or 0.03 when tested in accordance with ASTM E 96 Procedure A.
      c. Flame Spread Index < 25 and Smoke Developed Index < 50 when tested in accordance with ASTM E 84.
      d. Color:
         1) Bright White, Sky Blue Backing.
   3. Vapor barrier adhesive. Complies with the following:
      a. BayGrip™ Contact Adhesive; CA Compliant.
      b. BayGrip™ Fast Dry Pressure Sensitive Adhesive; CA Compliant.
   4. Double sided vapor barrier tape. Complies with the following:
      a. SkyLiner Double-Faced Tape.
      b. 2" width.
   5. Patch tape. Complies with the following:
      a. SkyLiner Repair Tape.
   6. Metal Banding/Straps. Complies with the following:
      a. SkyLiner® Banding, 1" x 0.023 continuous length metal banding.

b. Exposed color to match vapor barrier.
1) White.

7. Thermal breaks.
a. Thermal spacer blocks. Complies with the following:
1) 0.5" HD ISO high density, closed cell, polyisocyanurate foam core with R-Value of 2.5, compressive strength 120 psi, Density 5 pcf and Pull Through Resistance of 210 lb per ASTM D 473 as manufactured by GenFlex, Tel.: (800) 443-4272 or approved equal.
a) Metal Wall and Roof Panel engineer shall review and approve that thermal spacer blocks are compatible.
2) Minimum width 3.0".
3) Thickness 0.5" (HOLD).

8. Fasteners & Clips.
a. SkyLiner® Safety Clip System, to include offset clip + fastener + banding, 16" either side of each frame. (Required for fall protection installation.)
b. Tek 2 and Tek 4.5.

9. Insulation Hangars.
a. SkyLiner® SkyHook™ for Walls.
b. SkyLiner® Insul-Hold for Walls, insulation hangars.

2.03 OTHER MATERIALS

A. Provide materials including fasteners and retainers, not specifically described but required for complete and proper installation of building insulation, selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this section will be installed. Verify that adjacent materials are dry and ready to receive insulation. Verify structure, bracing, and concealed building systems have been tested and inspected.

B. Provide written report listing conditions detrimental to performance of work in this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install liner system in accordance with manufacturer's installation instructions and approved shop drawings.

B. Purlin and girt attachment surfaces should be clean and dry prior to attaching two-faced tape or sealing adhesive.

C. Installed fiberglass insulation should fit snugly against purlin and girt walls in the cavity space. Avoid gaps, voids, and any excess compression.

3.03 CLEANING

A. Clean dirt from vapor barrier fabric using a soft cloth with soap and water or non-abrasive household cleaner. Solvent-based cleaners and abrasive pads should be avoided.

3.04 APPENDIX

A. Refer to the Bay Insulation Systems publications listed below for product information, including uses, descriptions, physical properties, performance, specification compliance and application recommendations. Copies of these documents can be found at www.bayinsulation.com.
   1. SkyLiner® New Construction Installation Instructions - Bay Publication 13290508.
   2. SkyLiner® New Construction Walls Installation Instructions - Bay Publication 13290509.
   3. SkyLiner® White Fabric Specification Sheet - Bay Publication 13290216.
   4. SkyLiner® Black Fabric Specification Sheet - Bay Publication 13290211.
   5. BayGrip™ for SkyLiner® Data Sheet- Bay Publication 13290306.
   6. BayGrip™ Spray for SkyLiner® Data Sheet- Bay Publication 13290307.

END OF SECTION 07 21 16

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide vapor barrier and installation accessories for installation under concrete slabs.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Quality control/assurance:
   1. Summary of test results per paragraph 9.3 of ASTM E1745.
   2. Manufacturer's samples and literature.
   3. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
   4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
   5. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.
   6. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
   7. Manufacturer’s verify in writing 20 years in the industry with no reported product failures.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E1745- 17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E1643-18a: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):

1. ACI 302.2R-06: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
2. ACI 302.1R-15: Guide to Concrete Floor and Slab Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Liner shall have all of the following qualities:
1. Maintain permeance of less than 0.01 Perms as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:
   a. Strength and Longevity: ASTM E1745.
   b. Thickness: 15 mils minimum
3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.
4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

B. Vapor barrier product:
1. Basis of Design: Stego® Wrap Vapor Barrier (15-mil) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Approved Alternate Manufacturers:
1. Griffolyn® Vaporguard® 15-mil manufactured by Reef Industries, 800-231-6074.
2. Moistop Ultra 15 by Fortifiber, (800) 773-4777. https://www.fortifiber.com/product/moistop-ultra-15/
3. **No Other Substitutions allowed.**

2.03 ACCESSORIES

A. Seams:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com

B. Sealing Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com

C. Perimeter/terminated edge seal:
1. Stego Crete Claw (textured tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com
2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com
3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com

4. One-sided seaming tape is not a recommended method of sealing at the terminated edge.

D. Penetration Prevention:
   1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com

E. Vapor Barrier-Safe Hand Screed System
   1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
   1. Level and compact base material.

B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.02 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.
   1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
   2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, water stops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
      a. Seal vapor barrier to the entire slab perimeter using manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
   3. Overlap joints 6 inches and seal with manufacturer's seam tape.
   4. Apply seam tape/textured tape/double-sided tape to a clean and dry vapor barrier.
   5. Seal all penetrations (including pipes) per manufacturer's instructions.
   6. Avoid the use of stakes driven through vapor barrier by utilizing screed and forming systems that will not leave punctures in the vapor barrier.
   7. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

END OF SECTION 07 26 16

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PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers the pre-finished, pre-fabricated Architectural standing seam roof system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.

B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

C. Related Work Specified Elsewhere
   1. Roof Deck structural steel, flat roof systems, perimeter edge systems. Roof hatches, firestopping not included in this section.
   2. Pre-Engineered Metal Buildings. Refer to Section 13 34 19 - Metal Building Systems.

D. Material to comply with:
   1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.
   1. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by any proposed substitution.

C. Shop drawings: Show fabrication and installation layouts of metal roof panels, metal wall panels or metal soffit panels, details of edge conditions, side-seam joints, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work

D. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, base don input from installer of the items involved:
   1. Roof panels and attachments, including thermal spacer blocks.
   2. Metal trusses, bracings and supports
   3. Roof-mounted items including snow guards and items mounted on roof curbs.

1.04 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight roofing system.

B. References:
   1. American Society for Testing and Materials (ASTM)
      a. ASTM A 653: Steel Sheet, Zinc Coated by the Hot Dip Process
      b. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process
      c. ASTM B 209: Aluminum and Aluminum Alloy Sheet and Plate
      d. ASTM B370 Standard Specification for Copper Sheet and Strip for Building Construction
   2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
      a. SMACNA Architectural Sheet Metal Manual, 1993 edition
   3. American Iron and Steel Institute (AISI)
      a. AISI Cold Formed Steel Design Manual
   4. Aluminum Association
      a. Aluminum Design Manual
   5. Metal Construction Association
      a. Preformed Metal Wall Guidelines
   6. Code References
      a. ASCE, Minimum Loads for Buildings and Other Structures
      b. BOCA National Building Codes
      c. UBC Uniform Building Code
      d. SBC Standard Building Code

1.05 ROOF SYSTEM PERFORMANCE TESTING

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.

B. Roof System shall be designed to meet Standard Building Code Wind Load requirements.

C. Panels to meet:
   1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.

2. Roof System shall be designed to meet a UL Class 90 wind uplift in accordance with UL standard 580 and panel system shall be ASTM 1592 Tested and approved
3. UL 2218 - Impact Resistance rated.

1.05 QUALITY ASSURANCE

A. Petersen Aluminum Corp, Tyler, TX, 800-441-8661 products establish a minimum of quality required.

B. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.

C. Panels shall be factory-produced only. No portable, installer-owned or installer-rented machines will be permitted.

1.05 PRE-INSTALLATION CONFERENCE

A. Prior to installation of roofing system, conduct a pre-installation conference at the project site. Verify responsible provider and installer of thermal spacer blocks and sequencing.

B. Attendance: Owner, Architect, Contractor, Project Superintendent, and Certified Installer.

C. Agenda:
1. Roofing details and agenda.
2. Critical work sequencing and review of phasing plan.
3. Inspection sequencing.

1.06 WARRANTY

A. Weathertight warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
1. Warranty Period: 20 Years from date of Substantial Completion

B. Finish warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace standing seam metal roof panels that show evidence of deterioration of factory-applied finish within specified warranty period.
1. Exposed Panels Finish - deterioration includes the following:
    a. Color fading more than 5 hunter units when tested according to ASTM D 2244
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214
    c. Cracking, checking, peeling or failure of a paint to adhere to a bare metal.
2. Warranty Period: 20 Years from the date of substantial completion

C. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

1.07 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.

B. Deliver components, sheets, metal roof panels and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

C. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.

D. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting or other surface damage.

E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.07 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.

B. Coordinate metal roof panels with rain drainage work, flashing, trim and construction of decks, parapet walls and other adjoining work to provide a leakproof, secure and non-corrosive installation.

PART 2 - PRODUCTS

2.01 PANEL DESIGN

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weathertight installation.

B. Roof panels shall be standing seam Tite-Loc Plus in 16" widths with 2" high seams that are mechanically seamed together @ 90 degrees.

C. Panels to be produced with Factory supplied hot melt mastic in the seams.

D. Panels to be produced Smooth - Factory Standard.

E. Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.

F. Forming: Use continuous end rolling method. No end laps on panels. No portable roll-forming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.02 ACCEPTABLE MANUFACTURERS

A. This project is detailed around the roofing product of Petersen Aluminum Corporation Petersen Aluminum Corp, Tyler, TX, 800-441-8661, Tite-Loc.

B. Approved equivalent system by one of the following manufacturers will be considered:
   1. AEP Span
   2. Berridge
   3. Exceptional Metals
   4. McElroy Metal
   5. Metal Sales
   6. MBCI

2.03 MATERIALS AND FINISHES

A. Preformed roofing panels shall be fabricated of 24 GA Steel

B. Color to be selected by Architect from manufacturer's complete line.

C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.

D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.

E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.

F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.

G. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.

H. Substrate shall be Pre-Engineered Metal Building roof structure designed for application over open purlins and blanket insulation. Verify responsible trade that will provide and install specified thermal space blocks, including sequence.

I. Sealants
   1. Exterior grade silicone sealant recommended by roofing manufacturer.

2.04 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.

B. Fabricate components of the system in factory, ready for field assembly.

C. Fabricate components and assemble units to comply with fire performance requirements specified.

D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

2.05 SNOW RETENTION SYSTEM

A. Snow Retention System:
   1. Provide PAC_Clad ColorGard utilizing the patented S-5! Clamp for its strength. S-5! utilizes round-point set screws for attachment which are specially made for the S-5! ColorGard or SnoFence™ snow retention system.
   2. Finish: Components to match the same paint finish color as the metal roof panels.

2.06 GUTTERS AND DOWNSPOUTS

A. Provide 24 gauge steel 8" PAC-Tite Gold Gutter Profile IGG-B (Box Type), color to match roof panel. Include 30-Year Kynar 500® Finish Warranty on coil-coated standard colors.
   1. Include 2” wide external wind strap to be installed every 6’ and gutter straps every 24” O.C. to comply with the ANSI/SPRI GT-1 Standard.
   2. Include heavy aluminum gutter strap design that eliminates the need for drilling and riveting. Free-floating, hook-in strap allows for full thermal movement of the gutter. Provide roof flange.

B. Provide PAC-Tite LT Industrial Downspout (Closed), color to match roof panel. Include 30-Year Kynar 500® Finish Warranty on coil-coated standard colors.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.

B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.

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

3.02 FASTENERS

A. Secure units to supports

B. Place fasteners as indicated in manufacturer's standards.

3.03 INSTALLATION

A. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.

B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.

C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.04 DAMAGED MATERIAL

A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION 07 41 13

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PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of metal panels is shown on the drawings and indicated by provisions of this section.

B. Related work specified elsewhere:
1. Structural steel.
2. Steel girts and furring.
3. Wood sheathing.
4. Rough carpentry.
5. Flashing and sheet metal. (Not wall panel related).
6. Air barrier and vapor retarder.
7. Thermal insulation.
8. Sealants.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Design Test Reports.
1. Submit copies of design test reports for each of the performance testing standards.
2. Test reports shall be performed by independent, accredited testing laboratories, and shall bear the seal of a registered professional engineer.

D. Warranty: Provide unexecuted specimen warranty documents for each warranty as required in specification article 1.07.

E. Samples.
1. Submit sample of panel section, at least 6" x 6" showing seam profile, and also a sample of color selected.
2. Submit sample of panel clip, foam closures, and field applied sealants.

1.04 DEFINITIONS

A. American Architectural Manufacturer Association (AAMA):
   1. AAMA 621-96: Voluntary/Standard Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates

B. American Iron and Steel Institute (AISI):
   1. S100-07: 2007 Edition of the North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Society of Civil Engineers (ASCE):
   1. ASCE 7-05: Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):
   1. A653-03: Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. A755-03: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. A792-03: Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. B209-02a: Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. D1056-00: Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
   6. D3575-00e1: Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.
   7. E283-04: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   8. E330-02(2010): Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
   9. E331-00(2009): Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   10. E1886-02: Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
   11. E1996-09 Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

1.04 QUALITY CRITERIA / INSTALLER QUALIFICATIONS

A. Engage an experienced metal wall panel contractor (erector) to install wall panel system who has a minimum of three (3) years experience specializing in the installation of metal wall systems.

B. Contractor must be certified by manufacturer specified as a supplier of the metal wall system and obtain written certification from manufacturer that installer is approved for installation of the specified system.

C. Successful contractor must obtain all components of wall system from a single manufacturer. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.

D. Fabricator/Installer shall submit work experience and evidence of adequate financial responsibility. Architect reserves the right to inspect fabrication facilities in determining qualifications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

C. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from any debris.

1.06 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal wall panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal wall panels by field measurements before fabrication.

1.07 WARRANTIES

A. Endorse and forward to owner the following warranties:
   1. Manufacturer's standard 10 year wall system weathertightness warranty, jointly signed by the installer and manufacturer. The warranty shall not place any limitations on wind speed, up to a maximum design wind speed as given in this specification.
   2. Manufacturer's standard 20-year finish warranty covering checking, crazing, peeling, chalking, fading, and adhesion of the pre-painted sheet metal materials.
   3. Installer's 3-year warranty covering wall panel system installation and watertightness.

B. Warranties shall commence on date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide systems by IMETCO (Latitude™ Wall Panel System: LW-1). Tel.: (800) 646-3826 or equivalent system by one of the following manufacturers:
   1. Atas
   2. Berridge
   3. Exceptional Metals
   4. McElroy Metal
   5. Metal Sales
   6. MBCI
   7. PAC-Clad Petersen Aluminum Corp.
   8. Approved equal

2.02 WALL PANELS

A. Standard Profile: Concealed Fastener Metal Panels with rounded interlocking legs meeting ASTM E 330. Provide 30-year non-prorated finish warranty.
   1. Basis of Design: IMETCO Latitude LW-1 profile.
   2. Coverage Width: 16 inches with vertical panel orientation
   3. Standard Profile: Ribs at 4 inches on center.
   4. Height: 7/8 inches
   5. Nominal Coated Thickness: 24 gage.
   6. Panel Surface: Smooth
   7. Panel Length: Up to 21 feet maximum length.
   8. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
   9. Exterior Finish: Fluoropolymer two-coat system.
   10. Color: As selected by Architect from manufacturer's standard colors.

2.03 ENDLAPS

A. Pre-punch endlaps and provide an 18 gauge pre-punched backup plate and a 16 gauge pre-punched cinch strap for proper placement of fasteners.

B. Apply mastic between the panels and secure with self tapping fasteners through the cinch strap, panels and backup plate to form a compression joint.

2.04 FASTENERS

A. Provide manufacturer's recommended Lifetime self-drilling exposed fastening method.
   1. Panel Fasteners For panel to panel and panel to purlin connections to be No. 12-14 by 1 in. self-drilling, self tapping, hex head, plated steel screws with a 5/8-

inch OD formed steel washer and a neoprene sealing washer.

a. Alternate Fasteners - For panel to purlin connections, 1/4 - 14 HHAB self-tapping, plating steel screws, with a separate 5/8 in. OD dome shaped steel washer and a neoprene sealing washer may be used.

b. No. 14-10HHA, self-tapping, plating steel screws, with a separate, 5/8 in. OD dome shaped steel washer and a neoprene sealing washer may be used.

2. Spacing, for panel - to - purlin connections to be 12 in. on center beginning 2 - 1/2 in. from center line on one side of each major rib. Spacing at end lap to be in a 5 - 7 - 5 - 7 in. pattern beginning 2 - 1/2 in. from the center line on both sides of each major rib.

3. Fastener for panel to purlin connection to be 1-1/4 in. long when insulation is greater that 4-1/2 in. Spacing for panel - to - panel connections to be 20 in. on center with a fastener located in line with the purlin fasteners

2.05 SEALANTS AND CLOSURES

A. Factory applied sidelap sealant is to be non-drying synthetic polymer based, designed for metal to metal concealed joints.

B. Field applied panel end sealant is to be extruded polymeric butyl tape.

C. Manufacture outside closures from same material as wall panel.

D. Manufacture inside closures from 18 gauge metal or neoprene.

2.06 FLASHING, TRIM AND ACCESSORIES

A. Flashing shall not compromise the integrity of the wall system by constricting movement due to thermal expansion and contraction.

B. Finish to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation to match wall panels.

1. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils DFT.

C. Panel manufacturer to supply flexible membranes if applicable.

D. Manufacture all trim and flashing from Galvalume sheet steel.

E. All penetrations shall be flashed by panel installer and become a part of the panel manufacturer's weathertightness warranty.

2.07 THERMAL SPACER BLOCKS

A. Thermal Spacer Block shall comply with the following:
   1. 0.5" HD ISO high density, closed cell, polyisocyanurate foam core with R-Value of 2.5, compressive strength 120 psi, Density 5 pcf and Pull Through Resistance of 210 lb per ASTM D 473.
      a. Respective Metal Wall and Roof Panel engineer shall review and approve that thermal spacer blocks are structurally compatible.
   2. Minimum width 3.0".
   3. Thickness 0.5" (HOLD)

2.08 LINER PANELS

A. Interior wall paneling to be VP LPR-36, 36 inch wide 28 gauge with 1-1/4" high ribs screwed to framing with self-drilling fasteners. Provide partial-height liners attached to 7'-4" high girt, extending 2" above girt. Attach bottom of panel to base girt or channel as a component of the metal building system or as required. Liner panel to be ASTM A653 Grade 33 steel with a zinc coating. The panel is painted with a white polyester finish on one side and a gray primer coating on the second side. Approved equal product will be considered.

PART 3 - EXECUTION

3.01 EXAMINATION

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

B. Examine primary and secondary wall framing to verify that girts, studs, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal wall panel manufacturer.

C. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

D. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

E. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

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

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. - Not Used -

C. Miscellaneous Framing: Install sub-framing, furring, and other miscellaneous wall panel support members and anchorage according to metal wall panel manufacturer's written instructions.

D. Establish straight, side and crosswise benchmarks

E. Use proper size and length fastener for strength requirements. Approximately 5/16 inch (8 mm) is allowable for maximum fastener head size beneath the panel.

F. All walls shall be checked for square and straightness. Inside and outside corners may not be plumb; set a true line for the corner units and flashing with string line.

G. Measure the wall lengthwise to confirm panel lengths and verify clearances for thermal movement.

3.03 METAL WALL PANEL INSTALLATION

A. All details will be shown on in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.

B. Directly over the PEMB Blanket Insulation System draped over horizontal Z-Girts, install one piece clips on 1/2-inch Thermal Spacer Blocks. All anchor clips will be fastened into the PEMB Z-Girts as recommended by published manufacturer recommendations.

C. Installation of Wall Panels: Wall panels can be installed by starting from one end and working towards the opposite end (vertical orientation), or from the bottom of wall working towards the top of the wall (horizontal orientation).

D. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating where required. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

E. Limit exposed fasteners to extent indicated on contract drawings.

F. Seal laps and joints in accordance with wall panel system manufacturer's product data.

G. Coordinate flashing and sheet metal work to provide weathertight conditions at wall terminations. Fabricate and install in accordance with standards of SMACNA Manual.

H. Provide for temperature expansion/contraction movement of panels at wall penetrations and wall mounted equipment in accordance with system manufacturer's product data and design calculations.

I. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

J. At joints in linear sheet metal items, set sheet metal items in two ¼-inch- (6-mm-) beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

K. Remove damaged work and replace with new, undamaged components.

L. Touch up exposed fasteners using paint furnished by the panel manufacturer and matching exposed panel surface finish.

M. Clean exposed surfaces of wall panels and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

3.04 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet at location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.05 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect metal wall panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install metal flashing and sheet metal work specified.
   1. Flashing and Counter-flashing
   2. Gutter with Leaf Screen Gutter Guard and Downspouts and Splashblocks
   3. Drip Edge
   4. Trim
   5. Cricket
   6. Chase Cover
   7. Other work indicated and required by project

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Job Supervision: Applicator of work in this Section to furnish competent, qualified foreman present and in charge at all times work is performed.

B. Applicable Standards:
   1. ANSI/SPRI/FM 4435/ES-1-11 “Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems”, and NRCA Guidelines for Complying With Building Codes Using ANSI/ SPRI ES-1. Provide shop drawings, to include wood blocking, to meet this standard or certified third party test data for gravel stop, fascia profiles and coping. Refer to the drawings for design wind load parameters. Include wind loads for roof area perimeters and corners on submittals.
   2. Refer to the current edition of the "Architectural Sheet Metal Manual" of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA). Use as applicable standard for method and quality of work under this Section where not specifically otherwise shown in Contract Documents. Manufacturer to provide trained metal craftsmen to supervise installation.

3. ASCE 7: Minimum Design Loads for Buildings and Other Structures.

4. ANSI/SPRI GT-1 2016 (R2022) - Test Standard for External Gutter Systems per Arkansas Code or the 2021 International Building Code.

1.05 WARRANTY

A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 NBS units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.

B. Guaranty: Guaranty sheet metal work installed under this Section against leakage or defects for 2 years after substantial completion date. Make good at Contractor expense leakage or defects occurring within this period.

PART 2 - PRODUCTS

2.01 SHEET METAL

A. G-60 Galvalume Steel: Aluminum-zinc alloy coating AZ50, meeting ASTM A792. Keep Galvalume dry during transit, in storage, and at work site.
   1. At locations where flashing is visible from outside building, finish to be Kynar 500® based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect from manufacturer's complete line.
      a. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils DFT.
      b. Approved equal: Hylar 5000®.
   2. Provide mill finish at locations not visible from outside building or public view.

B. G-90 Bare Galvanized Steel: Conform to ASTM A525 General Requirements and to ASTM A526, Commercial Quality for hot-dip galvanizing (HDG) process. Zinc coating weight not less than 1-1/4 ounces per square foot nor more than 1-1/2 ounces per square foot of surfaces covered and conforming to ASTM A90, Table X1.1, measurement.

C. Aluminum Sheet: Provide 3003-0 alloy for flashings. For all other sheet metal work furnish 3003-14 alloy.
   1. Factory finish with oven cured Kynar 500® based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect from manufacturer's complete line.
      a. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils DFT.
      b. Approved equal: Hylar 5000®.

D. Soft Temper Sheet Metal: Lead sheet, F.S. QQ-L-201, Grade B, 4 lb. per sq. ft.

E. Gauge of Metal:
   1. Metal components of a roof assembly: 24 gauge (USS .025") minimum
   2. Scuppers, guttering, down spouts and splash pans (roof locations): 22 gauge (USS .0312") minimum. Gutter straps to be 18 gage.
   3. Through-Wall Flashing: 26 gauge minimum

2.02 GUTTER SYSTEM

A. Provide accessories for complete installation including end pieces, caps, elbows, outlet tubes, mitres, hangers and basket type strainers. Conform to ANSI/SPRI GT-1 2016 (R2022) - Test Standard for External Gutter Systems per Arkansas Code (2021 IBC).
   1. Box Gutter: 8" A-Style. Provide continuous removable Leaf Screen with sheet metal frame and stainless steel screen by LeafFilter® or approved equal microscreen type.
   2. Box Downspout: 4" x 5", up to 11" x 11" as required, with mitred elbows.

B. Manufactured from Galvalume sheet steel in minimum 10 foot lengths, tapered and notched to provide a 1" telescoping lap joint. Seal watertight, and secure with 1/8" rivets, or join sections with flat locked soldered seams.

C. Space gutter hangers and braces not more than 36" apart and secure with screws, bolts or approved clips. Brackets to be of compatible material to gutter, with matching finish and color.

D. Slope gutter 1" in 20 feet to down spout to avoid ponding.

E. Make leaders (downspouts) with 1-1/2" telescoped joints or full length without joints. Set leaders plumb, clear of walls. Secure with straps not over 6 feet apart and space so one is near top and another near bottom.

F. Finish: Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect from manufacturer's standard line.

2.03 GUTTER GUARD

A. Provide gutter guard system as supplied by LeafBlaster Pro®, 4031 Aspen Grove Dr, Ste 450, Franklin, TN 37067, (866) 483-8166 or approved equal. Provide 40-Year Warranty.
   1. Stainless Steel Micro-Mesh with Z-Bend Technology.

B. Provide Rainwater Diverters, Fascia Mount Supports, Rails and other accessories as required for a complete installation. Install per manufacturer’s published recommendations.

2.04 ACCESSORIES

A. Fasteners: All metal counter flashing and parapet cap flashing shall be attached with galvanized or cadmium plated screws with neoprene washers. Nails, screws and rivets used at other locations are to be the appropriate type for the purpose as described in the latest edition of the SMACNA Design Manual.

B. Solder for Lead: ASTM B 32, 50% tin and 50% lead used with rosin flux.

C. Roofing Cement: F.S. SS-C-153, Type I, Class A (summer grade) or Class B (winter grade) as applicable.

D. Bitumastic Coating: F.S. TT-C-494, MIL-C-18480, or SSPC - Paint 12, cold applied solvent type bitumastic coating for application in dry film thickness of 15 mils per coat.

E. Splash Blocks: Provide 36" long x 11-1/2" wide x 2-3/4" high High Strength Concrete as manufactured by Nitterhouse Masonry Products, LLC, (717) 268-4137 or approved equal at each Down Spout location or as indicated on the drawings.
   1. Plastic or composite splash blocks will not be allowed.

2.05 FABRICATION

A. Fabricate all metal flashing, counter-flashing, trim and related items to comply with profiles and sizes required. Fabricate to comply with the latest edition of the SMACNA "Architectural Sheet Metal Manual", metal manufacturer's recommendations, and recognized industry practices.

B. For continuous running work, fabricate with expansion joints in flashing, spaced sufficiently close to prevent flashing damage and failure in resistance to water penetration. Form flashing to fit substrate in each application.

C. Where sheet metal is required and no material or gauge is indicated on the Drawings, furnish and install highest quality and gauge commensurate with the referenced applicable standard, (SMACNA Manual, latest edition).

2.06 OTHER MATERIALS

A. Provide materials, not specifically described but required for complete and proper installation of flashing and sheet metal, of new materials, first quality of their respective kinds, and subject to approval of Architect.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to work of this Section, carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with sheet metal installation in areas of discrepancy until discrepancies are resolved.

3.02 WORKMANSHIP

A. General: Form sheet metal accurately to dimensions and shapes required, watertight and weather-tight, with angles and broken surfaces true, sharp, and in straight lines. Where intercepting other members, cope to an accurate fit and solder securely. Produce flat surfaces free from waves and buckles.

B. Expansion: Allow a 3/8"-1/2" gap in coping caps between each section. Use 3-1/2" wide pre-finished 24 gage cover plate over joints.
   1. Set cover plates in visible bead of polyurethane sealant between the cap and cover plate. Wipe joints of excessive sealant.
   2. Attach cover plate at the front and back with hex head cadmium screws with neoprene washers, installed in the gap between the metal cap sections.
   3. Do not exceed maximum length of 10'-0" for cap, fascia and flashing sections. Furnish with factory formed slots or enlarged holes for fasteners.

C. Paint metal in contact with mortar, concrete, and masonry materials with an alkali-resistant coating. Use heavy-bodied bituminous paint or approved equal.

END OF SECTION 07 60 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes firestopping and/or soundproofing for through-penetrations and joints in or between the following fire-resistance rated assemblies, including both blank openings, linear openings, and openings containing penetrating items:

B. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
   1. Walls and partitions.
   2. Smoke barriers.
   3. Construction enclosing compartmentalized areas.

C. This Section describes the requirements for furnishing and installing firestopping for fire-rated construction. Contractor is responsible for identifying various conditions requiring firestopping material and for submitting proposed UL Tested Assemblies for Architects review.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Material Safety Data Sheets: Submit MSDS for each firestop products.
   2. Shop Drawings: Show typical installation details for methods of installation. Indicate which firestop materials will be used where and thickness for different hourly ratings.
   3. Installer Documentation: Submit document from Firestop Manufacturer wherein Manufacturer recognizes, i.e. approves installer for said Manufacturer's Firestop products.
   4. Prepare job mock-up of the material proposed for use in the project as directed by Architect. Approved mock-ups may be left in place as part of the finished project and will constitute the standard for remaining work, including aesthetics. It is recommended that the Authority Having Jurisdiction (AHJ) or Fire Marshal review and comment on the job mock-up and contractor is to notify architect of AHJ observations.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Firestopping materials shall conform to Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E 814 or UL 1479 fire tests. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating, when required by code authority, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

B. Firestopping material shall be asbestos free and free of any PCBs.

C. Do not use any product containing solvents or that requires hazardous waste disposal.

D. Do not use Firestop Products which after curing, dissolve in water.

E. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

F. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.05 PRODUCT DELIVERY, STORAGE AND HANDING

A. Deliver material in the manufacturers' original, unopened containers or packages with manufacturer's name, product identification, lot numbers, UL-labels, and mixing and installation instructions, as applicable.

B. Store materials in the original, unopened containers or packages, and under conditions recommended by manufacturers.

C. All Firestop materials shall be installed prior to expiration of shelf life.

1.06 PROJECT CONDITIONS

A. Conform to Manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

1.07 WARRANTY

A. Firestop Contractor shall warranty that firestopping systems used meet firestopping requirements as herein specified.

1.08 SEQUENCING

A. Coordinate this work as required with work of other trades.

B. Firestopping shall precede gypsum board finishing.

1.09 PROTECTION

A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide materials from one of the following manufacturers:
   1. 3M
   2. Cafco
   3. Hilti
   4. STI Firestop
   5. Approved Equal.

2.02 MATERIALS

A. Provide mortars, sealants, caulks, putty, collars, pillows, wrap strips, composite sheets and related materials as required by the UL Design Assembly proposed for each individual application.

B. Accessories:
   1. Forming/Damming Materials: Mineral fiberboard or other type recommended by manufacturer.
   2. Primer, Sealant and Solvent Cleaner: As recommended by manufacturer.

C. Seal all penetration of sound isolating construction with non-hardening material.

D. At sound isolating construction with multiple penetrations in a relatively small area, provide Nelson Class 200 multi-cable transit system as manufactured by Nelson Firestop Products, 1-800-331-7325, or approved equal.

2.03 SAFING INSULATION

A. Provide semi-rigid product designed for use as a fire stop that is non-combustible and non-corrosive to steel as manufactured by Thermafiber Div. of USG Interiors; Cafco Industries Ltd.; Roxul, or approved equal product combining semi-refractory mineral fiber manufactured from slag with thermosetting resin binders to comply with ASTM C665, Type I; minimum density of 4.0 pcf; passing ASTM E136 for combustion characteristics and with Fire Hazard Classification when tested according to ASTM E84; flame spread of 15 or less, fuel contribution of 0 and smoke development of 0.

B. Curtain Wall Assembly, Spandrel Panels, and Perimeter Joint Protection: Provide Intertek Design No. CEJ 322 P or propose alternate system meeting design conditions, to include the following:
   1. Reinforcing angle at horizontal butt joints
   2. Perimeter Fire Barrier Reinforcement Angle
   3. Curtain Wall Insulation, 2" thick (aluminum foil scrim on interior side of room)
   4. Impaling Screws
   5. Elastomeric Firestop Spray
   6. Other components required for a complete system

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where Firestops are to be installed and notify the architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the architect.

B. Verify that environmental conditions are safe and suitable for installation of Firestop product(s).

3.02 CONDITIONS REQUIRING FIRESTOPPING

A. General:
   1. Provide firestopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing, or otherwise.
   2. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.

B. Building Exterior Perimeters:
   1. Where exterior facing construction is continuous past a structural floor, and a space would otherwise remain open between the inner face of the wall construction and the outer perimeter edge of the structural floor, provide firestopping to equal the fire resistance of the floor assembly. Mineral wool by itself is not an acceptable firestop, neither is mineral wool used with beads of

caulking applied along length of mineral wool/curtain wall or mineral wool/floor slab junctures. If mineral wool is part of firestop system, the mineral wool must be completely covered by appropriate thickness of UL listed Firestop Sealant.

2. Firestopping shall be provided whether or not there are any clips, angles, plates, or other members bridging or interconnecting the facing and floor systems, and whether or not such items are continuous.
3. Where an exterior wall of composite type construction passes a perimeter structural member, such as a girder, beam, or strut, and the finish on the interior wall face does not continue up too close with the underside of the structural floor above, thus interrupting the fire-resistive integrity of the wall system, and a space would otherwise remain open between the interior face of the wall and the lower edge of the structural member, provide firestopping to continuously fill such open space.

C. Interior Walls and Partitions:
1. Where a wall or partition is continuous past a structural floor, such as at stairwells and vertical shafts, and a space would otherwise remain open between the wall face and perimeter edge of the adjoining structural floor, provide firestopping.
2. Provide firestopping whether or not there are any clips, angles, plates, or other members bridging or interconnecting the wall and floor systems, and whether or not such items are continuous.
3. Where the top edge of a fire-rated wall or partition abuts and is at right angle to fluted-type metal decking, and the construction is such that would otherwise leave the flute spaces open, provide firestopping.
4. Where the bottom track or plate of a partition meets the concrete slab provide firestopping sealant.
5. Where the bottom track or plate of a partition meets the top of the concrete block wall below the drywall partition provide firestopping sealant.

D. Penetrations:
1. Penetrations include conduit, cable, wire, pipe, duct, electrical boxes, fire extinguisher cabinets, toilet accessories or other elements which pass through or penetrate one or both sides of a fire rated floor, wall, or partition.
    a. If "5 sided" gypsum board enclosures are omitted where metal electrical back boxes not exceeding 16 square inches occur at one side only of a wall within a single stud cavity; provide fire stopping material described in this Section to completely encompass the back box and its annular space.
2. Except for floors on grade, where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining structural floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814.
3. Where penetrations occur at fire-rated walls or partitions of solid-type construction, provide firestopping to completely fill spaces around the penetration, in accordance with ASTM E 814.
4. Where penetrations occur at fire-rated walls or partitions of hollow-type construction, provide firestopping to completely fill spaces around the penetration, on each side of the wall or partition, in accordance with ASTM E 814.

5. These requirements for penetrations shall apply whether or not sleeves have been provided, and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, firestop annular space - if any - between sleeve and wall of opening.

E. Provide firestopping to fill miscellaneous voids and openings in fire-rated construction in a manner essentially the same as specified above.

3.03 INSTALLATION

A. General:
1. Installation of Firestops shall be performed by applicator/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply Firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Coordinates with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire related construction have been permanently installed prior to installation of Firestops, schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of Firestops.
4. At gypsum board fire walls the entire gap between the floor slab up to the bottom edge of the gypsum board is to be filled 100% and continuous.

B. Dam Construction: Install dams when required to properly contain Firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming materials may be left as a permanent component of the Firestop system.

C. Field Quality Control:
1. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
2. Follow safety procedures recommended in the Material Safety Data Sheets.
3. Finish surfaces of firestopping which is to remain exposed in the completed work to a uniform and level condition.
4. All areas of work must be accessible until inspection by the applicable Code authorities.
5. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.04 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

B. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

END OF SECTION 07 84 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish labor, materials, tools, and equipment required to completely close (with caulking compound or sealant) all joints to give a finished appearance. Items to be caulked or sealed include but are not limited to the following:
   1. Hollow metal frames.
   2. Exterior doors, louvers, windows and any other openings in exterior walls.
   3. Interior fixed glass.
   4. Penetrations by piping, conduit and similar items.
   5. Plumbing fixtures.
   6. Millwork.
   7. Flooring, including saw-cut concrete slab-on-grade.
   8. Paving and sidewalk joints.
   9. Dissimilar finishes.
   10. Joints shown on drawings or specified to be caulked or sealed.
   11. All joints or gaps between similar or dissimilar materials that do not receive closure trim are to be caulked/sealed with the appropriate material as listed in Part 2 of this Section.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Installer qualifications.

D. Contractor certification.

E. Manufacturer's installation instructions for each product used.

F. Cured samples of exposed sealants for each color.

G. Manufacturer's Literature and Data:
   1. Primers

2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

H. Manufacturer warranty.

1.04 REFERENCES

A. ASTM E84 (UL 723): Surface Burning Characteristics

B. ASTM E814 (UL 1479) and ULC-S115: Standard Test Method for Fire Tests of Through-Penetration Fire Stops

C. ASTM E1966 (UL 2079): Standard Test Method for Fire-Resistive Joint Systems

D. ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.05 QUALITY ASSURANCE

A. Qualifications of Applicators: Use workmen thoroughly skilled and specially trained in techniques of caulking, and completely familiar with manufacturer's published recommendations for caulking material used.

B. Rejection of Installed Caulking: Lack of skill by caulking installers is sufficient ground for Architect to reject installed caulking and to require its removal and complete recaulking at Contractor's expense.

C. Guarantee: Guarantee caulking materials and workmanship, in writing for 2 years after substantial completion date. Repair at Contractors expense any defects developing within guarantee period.

D. Submit manufacturer's product data sheets and color selection information for every brand and type of sealant, caulk and accessory item proposed for use on this project.

E. Refer to Underwriters Laboratories, Inc. (UL) Volume 2 with Hourly Ratings for Joint Systems, Through-Penetration Firestop Systems and Electrical Circuit Protective Systems and Duct Assemblies.

1.06 PRODUCT HANDLING

A. Protection: Protect caulking materials before, during, and after installation. Protect installed work and materials of other trades. In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

B. Storage: Store caulking materials and equipment under conditions recommended by manufacturer. Do not use materials stored for period of time exceeding maximum recommended material shelf-life.

1.07 JOB CONDITIONS

A. Inspection: Carefully inspect installed work of trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

C. Do not install sealants under adverse weather conditions, or when temperatures are not within manufacturer's recommended limitations for installation. Install sealants only when forecasted weather conditions are favorable for proper care and development of high early bond strength.

1.08 MOCK-UP

1. Provide a mock-up of each type of sealant using materials, colors, and techniques approved for use on the project. Approved mock-ups may be incorporated into the Work.

PART 2 - PRODUCTS

2.01 MATERIALS FOR CAULKING AND SEALING

A. Select caulking materials for specific locations complying with manufacturer's recommendations. Provide caulking, sealant and accessory items in color(s) selected to match adjacent materials or as selected by Architect from manufacturer's complete line.

B. Silicone Sealant: Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
   1. Silicone Sealant 790/791/795 by Dow-Corning Corp.
   2. Spectrum 1 by Tremco
   3. 890 FTS/864 NST by Pecora Corporation
   4. Approved Equal

C. Mildew-Resistant Silicone Sealant: Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
   1. Silicone Sealant 786 by Dow-Corning Corp.
   2. Sanitary 1700 by GE.
   3. Approved equal.

D. Acrylic Latex Caulk (interior only): General purpose, gun grade, non-sag, paintable, non-staining latex sealant complying with ASTM C834.
   1. AC-20 + Silicone by Pecora.
   2. Acrylic Latex by Tremco.
   3. Approved equal.

E. Acoustical Sealant: General purpose, gun grade, non-sag, paintable, non-staining latex sealant complying with ASTM C834.
   1. SHEETROCK® Brand Acoustical Sealant by U.S. Gypsum
   2. AC-20® FTR Acoustical and Insulation Sealant by Pecora Corporation
   3. STOPGAP by Auralex Acoustics
   4. Sashco Big Stretch Caulk
   5. Green Glue Noiseproofing Sealant
   3. Approved equal.

F. Polyurethane Sealant (for vertical surfaces): Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 35.
   1. MasterSeal® NP 1™ (formerly Sonolastic® NP 1™).
   2. Vulkem 921 by Mameco.
   3. Dynatrol I by Pecora.
   4. Dymonic by Tremco.
   5. QSC-102 by Carlisle.
   6. Approved equal.

G. Polyurethane Sealant (for horizontal surfaces): Single component, non-priming, self-leveling, pourable grade product meeting ASTM C920, Type S, Grade P, Class 25.
   1. MasterSeal® SL 1™ (formerly Sonolastic® SL 1™).
   2. Vulkem 45 by Mameco.
   3. NR-201 by Pecora.
   4. THC-901 by Tremco.
   5. QSC-131 by Carlisle.
   6. Approved equal.

H. Two component epoxy system (laboratory sink components) to withstand prolonged immersion in gasoline, gasohol, fuels, oils, alcohols, methyl, ethyl, butyl, ethyl acetates, toluene, as well as a wide number of other organic and inorganic solvents. Excellent mechanical properties including high tensile and compressive strengths.
   1. MasterBond®, Inc. EP21ARHT; Tel.: (201) 343-8983
   2. Viton® Fluoroelastomer Chemical-Resistant Sealant as provided by Master-Carr
   3. Approved equal

2.02 SEALANT BACKER RODS

A. Sealant Backer Rod for general use except at floor and deck joints: Tremco Open Cell Polyurethane, or approved equal, open cell type as recommended by sealant manufacturer for compatibility with sealant.

B. Sealant Backer Rod for use at horizontal floor and deck joints: MasterSeal® 920 by BASF, or approve equal closed cell type as recommended by sealant manufacturer for compatibility with sealant. MasterSeal® 921 by BASF may be used where appropriate.

C. Provide rod sized and shaped to control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

2.03 MISCELLANEOUS MATERIALS

A. Joint Cleaner Compound: Use type recommended by sealant and caulking compound manufacturer for joint surfaces to be cleaned.

B. Joint Primer/Sealer: Use type recommended by sealant manufacturer for joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Use self adhesive polyethylene tape or plastic tape recommended by sealant manufacturer. Apply to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.

D. Joint Filler: W.R. Meadows, Sealtight Standard Cork, Expansion Joint Filler produced from clean, selected, granulated cork bonded with a phenolic resin, or approved equal meeting ASTM D 1752, Type II.

2.04 GENERAL APPLICATION GUIDE

A. Interior caulking, except joints with ceramic tile, metal, glass and aluminum: Acrylic Latex Caulk.

B. Sound rated walls, partitions and ceilings: Acoustical Sealant.

C. Interior and Exterior joints with metal, glass and aluminum: Silicone sealant.

D. Joints with ceramic tile and plumbing fixtures: Mildew resistant Silicone sealant.

E. Horizontal and Vertical building joints: Polyurethane sealant.

F. Paving Joints: Refer to Division 32

G. Horizontal and Vertical building joints: High Performing Silicone
   1. Parking Structures
   2. Stadiums
   3. Horizontal sealing

PART 3 - EXECUTION

3.01 CHOICE OF CAULKING MATERIAL

A. Use sealant and caulking materials best suited to the installation and recommended by caulking material manufacturer.

3.02 INSPECTION

A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed. Do not proceed with joint sealer work until unsatisfactory conditions are corrected.

3.03 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealants and caulking compounds. Remove dirt, insecure coatings, moisture and substrates which could interfere with gasket seal and bond of sealant or caulking compound. Etch concrete and masonry joint surfaces when recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces recommended by sealant manufacturer.

B. Prime or seal joint surfaces where required, and when recommended by sealant manufacturer. Confine primer/sealer to areas of sealant bond. Do not allow spillage and migration onto adjoining surfaces.

3.04 INSTALLATION

A. Comply with manufacturer's printed instructions except when more stringent requirements are specified, and except when manufacturer's technical representative directs otherwise.

B. Set joint filler units at depth and position in joint as required to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

C. Install sealant backer rod except when required to be omitted or recommended to be omitted by sealant manufacturer for application required.

D. Install bond breaker tape when required by manufacturer's recommendations to ensure liquid-applied sealants will perform as intended.

E. Employ proven installation techniques, which ensure sealants are deposited in uniform, continuous ribbon without gaps or air pockets, and with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise required, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints occur between a horizontal surface and vertical surface, fill joint to form a slight cove, so joint will not trap moisture and dirt.

F. Install liquid-applied sealant to depths required and as recommended by sealant manufacturer.

G. Spillage: Do not allow sealants and compounds to overflow from joint confines or to spill onto adjoining work, or to migrate into voids of exposed finished. Clean adjoining surfaces to eliminate evidence of spillage without damaging adjoining surfaces.

H. Recess edges of exposed joint fillers slightly behind adjoining surfaces, unless otherwise required, so compressed units will not protrude from joints.

J. At joints in face brick and precast concrete, apply sand and ground up mortar to uncured sealant to match appearance of mortar joints.

3.05 CURE AND PROTECTION

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Cure and protect sealants in manner which will minimize increases in modules of elasticity and accelerated aging effects.

END OF SECTION 07 92 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide hollow metal doors, door frames and window frames required.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. ANSI A224.1 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

B. ANSI A250.3 - Test Procedure and Acceptance Criteria for Factory-Applied Finish Painted Steel Surfaces for Steel Doors and Frames.

C. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcements.

D. ANSI/ISDI-104 -Water Penetration Performance Standard for Insulated Steel Door Systems.

E. ANSI/ISDSI-103 - Acoustical Performance Standard for Insulated Steel Door Systems.

F. ANSI/ISDSI-105 - Mechanical Performance Standard for Insulated Steel Door Systems.

G. ANSI/SDI 100 - Recommended Specifications for Standard Steel Doors & Frames; Steel Door Institute.

H. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

I. ASTM B 117 - Standard Method of Salt Spray (Fog) Testing.

J. ASTM C 236 - Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box.

K. ASTM D 1735 - Standard Practice for Testing Water Resistance of Coating Using Water Fog Apparatus.

L. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

M. ASTM E 152 - Standard Methods of Fire Tests of Door Assemblies.

N. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

O. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure.

P. NFPA 80 - Standard for Fire Doors and Windows.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

R. SDI 105 - Recommended Erection Instructions for Steel Frames

S. SDI 111 - Recommended Standard Details - Steel Doors and Frames.

T. SDI 113 - Test Procedure and Acceptance Criteria for Apparent Thermal Performance for Steel Door and Frame Assemblies.

U. SDI 114 - Test Procedure and Acceptance Criteria for Acoustical Performance for Steel Door and Frame Assemblies.

V. SDI 116 - Test Procedure and Acceptance Criteria for Rate of Air Flow Through Closed Steel Door and Frame Assemblies.

W. Warnock Hersey International Inc. (WHI) - Certification Listings.

X. Uniform Building Code (UBC).

Y. UL 10B - Standard for Fire Tests of Door Assemblies.

Z. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Underwriters Laboratory Inc.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member of Steel Door Institute (SDI) or Hollow Metal Manufacturers Association (HMMA).

B. Use skilled workmen thoroughly trained and experienced and completely familiar with specified requirements and methods needed for proper performance of work of this Section.

C. Codes and Standards:
   1. Manufacture labeled units in strict accordance with specifications and procedures of Underwriters Laboratories, Inc. Labels must be affixed to rated assemblies.
   2. In guarantee and Shop Drawings, apply and use definitions and nomenclature established in American National Standards Institute publication A 123.1 "Nomenclature for Steel Doors and Steel Door Frames."
   3. ANSI/SDI A250.8-2017 - Specifications for Standard Steel Doors and Frames.
   4. Fire-Rated Units: **Affix metal plates to jamb side or top of door and/or frame stating the appropriate fire rating. Paper labels will not be accepted. Do not apply paint or stain over metal labels. Mask off the label before applying finish and remove masking after finish is dry.**

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protection:
   1. Deliver, store, and handle hollow metal units to prevent damage and deterioration.
   2. Provide packaging of cardboard or containers, separators, banding, spreaders, and paper wrappings to completely protect hollow metal units during transportation and storage.
   3. Store units upright, in protected dry area, at least one inch off ground and with at least 1/4" air space between individual pieces. Protect primed and hardware surfaces.
   4. Protect installed work and materials of other trades.
   5. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked units to promote air circulation.

B. Replacements: Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equal in all respects to new work, otherwise, remove and replace damaged items as directed at Contractor's expense.

1.07 WARRANTY

A. Provide Manufacturer's standard warranty, effective on date of purchase, against defects in product workmanship and materials; minimum 12 months for doors and frames.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fabricate hollow metal items rigid, neat in appearance, and free from defects, warp, or buckle.

B. Provide clean cut, straight and true molded members with well-formed and aligned miters.

C. Dress exposed weld joints smooth for a seamless appearance at frames and doors. Provide interlocking visible edge seams at door panel corners, not at middle of door edge.

D. Door Clearances: Maximum 1/8" at jambs and heads, 1/8" at meeting edges of pairs of doors, and 3/4" at bottom from finished floor line.

E. Close top and bottom edges of exterior doors flush. Seal against water penetration with flush steel channel fillers.

2.02 ACCEPTABLE MANUFACTURERS

A. Provide hollow metal units by the following or other approved equal manufacturer:
1. **National Custom Hollow Metal, 800-334-3070, 1701 E 22nd St, Little Rock, AR, 72206.** Exterior doors and frames; (Interior doors and frames optional).
2. Amweld
3. Ceco Door Products
4. Curries Company
5. Mesker Door
6. Pioneer

2.03 FACTORY PREPARATION

A. Prepare units to receive hardware scheduled in "Hardware" Section of these specifications and in accordance with ANSI/DHI A 115.

B. Cut, mortise, reinforce, drill, and tap units at factory, except drill and tap for surface applied hardware at job when hardware is applied.

C. Prepare door frames for rubber silencers to be provided with frames.

2.04 SHOP PRIME COAT FOR FIELD FINISHED DOORS AND FRAMES

A. Clean, treat, and prime exposed surfaces of hollow metal units, including galvanized surfaces. All exterior doors and frames shall be galvanized.

B. Clean steel surfaces free of mill scale, rust, oil, grease, dirt, and foreign materials before applying paint.

C. Apply shop coat of rust-inhibiting prime paint of even consistency to provide uniformly finished surface ready to receive finish paint.

2.05 FULL FLUSH TYPE DOORS

A. Construct exterior/interior doors to the designs and gages specified:
   1. **Exterior Doors and designated wet areas:** Hot dipped galvannealed steel, ASTM A653, ZF180, Class A60 coating, 16 gauge Extra Heavy Duty (except where heavier gauge required), with closed tops.
      a. Include galvannealed components and internal reinforcements.
      b. Core: Rigid Pre-Formed Closed Cell Polyisocyanurate (polyurethane) Board. 2 lb. PCF Density Average to conform to ASTM D2856. Core U- Factor = 0.100, R-Value = 10.0. STC Rating 28-30.
   2. **Interior Doors:** Hot Dipped galvannealed steel, ASTM A 653, ZF120, Class A40 coating, 18 gauge Heavy Duty (except where heavier gauge required), with no exposed face seams.

B. **Core material at Interior Doors:** To be either water-resistant honeycomb insulation core glued in place, rigid insulation core glued in place or rigid insulation core foamed in place. Core material at exterior doors is to be either rigid insulation core glued in place or rigid insulation core foamed in place.
   1. Honeycomb Insulation Core (Glued, Interior Only): Crushing strength of not less than 4,000 psf, and with lamination to withstand not less than 1,500 psf surface shear.

C. **Core material at Exterior Doors:** Shall be Polyurethane (ISO) insulation, R-Value 1.97, placed in the hollow core of the door. Verify testing if applicable as a fire rated door.
   1. Therma Hold, 800-334-3070 for door and frame, Lab Tested NCHM Thermal Rating Level Per ASTM C1363-19. Insulate Thermal Brake Frame Cavity with Mineral Wool. Caulk Frame Edge to adjacent wall. Apply Gasketing Door to Frame preventing air flow. Include Thermal Break Threshold and Sweep (NGP).

D. Provide doors complete with glazed panels where required. Glass is specified in Section 08 80 00.

E. Astragals: All pairs of doors on which the active leaf has latching hardware shall be provided with overlapping astragals. Exceptions are pairs of doors equipped with vertical rod exit devices and where open back strikes are provided.
   1. Exterior openings are to have astragals applied in such a manner as to cover the gap at the meeting stiles at the exterior side.
   2. Doors are to be sized to allow a 1/8" clearance between the meeting edges when an astragal is a part of the assembly as well as when there is no astragal required.
   3. The door supplier shall coordinate the need for astragals based upon the hardware specified and the label requirements of the door manufacturer. Shop drawings shall clearly indicate the type of astragals and where they are to be provided.
   4. The astragals can be either shop or field applied. Field applied astragals are to be shipped with necessary mounting fasteners.

2.06 FIRE DOORS

A. At fire rated openings, furnish doors bearing Underwriters' Laboratories or Warnok-Hersey label for fire rating required. Furnish overlapping metal astragal on pairs of fire doors except where equipped with approved rim type exit hardware and provided with a removable mullion.

B. For 1-1/2 hour (B) and 1 hour (B) doors used in stairway enclosures the average temperature developed on the unexposed side shall not exceed 450 degrees F at the end of 30 minutes of standard fire test exposure when tested in accordance with ASTM E 2074. The label attached to the door shall indicate compliance with this requirement.

2.07 METAL DOORS WITH VISION PANELS

A. Construct from "Flush Type Doors" and factory prepare to receive glass vision panels. Furnish non-removable glazing stops on outside of exterior doors and on secure side of interior doors. Furnish glazing beads on inside side of glass panels. Muntins, if required, to interlock at intersections and be securely fastened to door. Glass requirements specified in Section 08 80 00 - Glazing of these specifications.

B. All doors occurring in a smoke partition are to have an approved, rated vision panel of not less than 100 square inches.

2.08 WELDED DOOR FRAMES

A. Construct exterior/interior welded door frames to the designs and gages specified:
   1. **Exterior Door Frames and designated wet areas:** Hot dipped galvannealed steel, ASTM A 653, ZF180, Class A60 coating, 16 **[14]** gauge Extra Heavy Duty (except where heavier gauge required), with closed tops.
      a. Include galvannealed components and internal reinforcements.
      b. **Overhead Rain Drip Guard:** Provide Anodized or Dark Bronze Aluminum Drip Strip 1.5" high x 2.5" wide x required length(s) by NGP or approved equal, including stainless steel furnished fasteners. Coordinate with Door Hardware Schedule in Section 08 71 00 - Door Hardware. Rain Drip not required where exterior cover provided.
      c. **Therma Hold Exterior Thermal Break Frames:** Two-part frame applied to Thermal Gasketing and secured every 12” with #8 sheet metal screw. This method separates both sides of the frame jamb and header along the stop to create a barrier preventing temperature transfer from outside to inside.
         1) Insulate Thermal Brake Frame Cavity with Mineral Wool.
         2) Use Polyurethane (ISO) Core A60 Galvanneal.
         3) Caulk Frame Edge to adjacent wall.
         4) Apply Gasketing Door to Frame .
         5) Include Thermal Break Threshold and Sweep

2. **Interior Door Frames:** Hot Dipped galvannealed steel, ASTM A 653, ZF120, Class A40 coating, 18 gauge Heavy Duty (except where heavier gauge required), with no exposed face seams.

B. Secure headers and jambs at corners by external welding of faces. Grind smooth to provide invisible joints.

C. Provide frames with minimum of 3 anchors per jamb for adjoining wall construction and floor anchors for attachment at floor. Construct anchors using minimum 18 gauge steel.

D. At fire rated openings, furnish frames bearing Underwriters Laboratories, Inc. or Warnock-Hersey, International, Inc. label for fire rating required with anchors approved for type installation required.

2.09 FIXED GLASS METAL FRAMES

A. Fabricate hollow metal framing using 14 gauge cold rolled steel conforming to ASTM Designation A 366. Apply steel tube glass stops with flush head, countersunk screws, spaced maximum of 12" o.c. unless otherwise required. Fit joints neatly, miter at corners, and make welds invisible by grinding smooth. Provide tamper-proof type anchors.

B. Anchor frames to wall construction with anchors set not less than 2'-0" o.c. around perimeter of frame.

C. Glass requirements specified in Section 08 80 00.

D. At fire rated openings, furnish frames bearing Underwriters Laboratories or Warnock-Hersey International, Inc. label for fire rating required with anchors approved for type installation required.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine areas and conditions for work of this Section. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install hollow metal units in strict accordance with approved Shop Drawings and manufacturer's recommendations.

B. Set frames accurately, plumbed, aligned, and securely anchored.

C. Install finish hardware in strict accordance with manufacturers' recommendations. Eliminate hinge-bound conditions, making items operate smoothly with secure locking and latching.

3.03 ADJUST AND CLEAN

A. Immediately after installation, sand smooth rusted and damaged prime coat. Apply compatible touch-up air-drying primer.

B. Check and adjust operating finish hardware items, leaving hollow metal units undamaged and in proper operating condition.

C. Excessive filing or grinding of strike plate will not be accepted. Filing and grinding not to exceed 1/8" in any direction.

END OF SECTION 08 11 13

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide wood doors, complete. Refer to Door Schedule for types and sizes.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Markings: Furnish door with stamp, brand, or identifying mark indicating door quality and construction. Identifying mark or separate certification to include inspection organization name, identification of standard for door construction, and identity of plant to which stamp was issued.

1.05 REFERENCE STANDARDS

A. American Society for Testing and Materials: (ASTM) E 152, "Fire Tests of Door Assemblies".

B. Architectural Woodwork Institute (AWI) Quality Standards: Specifications and Quality Certification Program, Section 1300, "Architectural Flush Doors".

C. U.S. Dept. of Commerce Commercial Standards: CS 236, "Mat-formed Wood Particle Board".

D. Rated doors and frames must meet NFiPA 80. **Affix metal plates to jamb side or top of door and frame stating the appropriate fire rating. Paper labels will not be accepted. Do not apply paint or stain over metal labels. Mask off the label before applying finish and remove masking after finish is dry.**

1.06 WARRANTY

A. Warranty: Submit written agreement using door manufacturer's standard form, signed by manufacturer, contractor, and installer, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or which show photographing of construction below in face veneers, or do not conform to NWMA and AWI tolerance limitations. Warranty period is for lifetime of installation.

B. Limitation and Exclusions:
   1. Defects are not natural variations in color or texture of wood. Improper finishing is considered a defect.
   2. Warp not considered a defect unless it exceeds 1/4 inch in the plane of the door itself. Warp is distortion in the door itself and does not refer to relationship of door to frame. Term "warp" includes bow, cup and twist. Amount of warp in door is measured by placing a straight-edge on the suspected concave face of door at any angle (horizontally, vertically, diagonally), with door in installed position. Measurement of bow, cup, and twist is made at point of maximum distance between bottom of straight-edge and face of door.

1.07 PRODUCT HANDLING

A. Protect wood doors during transit, storage and installation to prevent damage, soiling and deterioration. Comply with the "On-Site Care" recommendations of NWMA pamphlet "Care and Finishing of Wood Doors" and with manufacturer's instructions.

B. Protection: Store doors in fully covered, well ventilated area. Protect from extreme changes in temperature and humidity.

C. Replace damaged doors at Contractor's expense.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide doors manufactured by one of the following:
   1. Algoma
   2. Eggers
   3. Graham
   4. Marshfield
   5. Mohawk
   6. Oshkosh
   7. VT Industries

2.02 GENERAL

A. Provide wood doors complying with applicable referenced standards for specified door kinds and door types.

1. ANSI/WDMA I.S. 1A, Extra Heavy Duty.
2. Adhesive: Type II.
3. Core: Structural composite lumber, except when mineral core is required for fire rating.

2.03 ACCESSORY COMPONENTS

A. Provide metal edges at all concealed vertical rod devices and at fire rated doors. Provide matching hardwood edges at all non-rated doors.

B. Provide solid wood glazing beads to match door facing at vision panels in non-rated doors and in sound rated doors. Provide metal glazing beads at rated doors with vision panels. Finish on metal glazing bead to match finish on hollow metal door frame.

2.04 SOLID CORE, ARCHITECTURAL FLUSH DOORS

A. All Solid Core, Architectural Flush Doors are to be manufactured in strict accordance with AWI Section 1300. Furnish, 5-Ply doors with AWI 1300-T-6 Type #5 Edge and with core fully bonded to stiles and rails with Type I Adhesive.

B. Structural Composite Lumber Core Doors: CROSSBANDS: 1/16" (1.6 mm) min. High Density Fiber (HDF), CORE: Structural Composite Lumber (SCL) with a density of 38-lbs/cubic foot. STILES: HD.1 edge style- Matching 5/8" hardwood laminated to 7/8" SCL. VE.1 edge style - Matching veneer edgebanding laminated to 1-3/8" SCL. ADHESIVE: Type-1 PVA (polyvinyl acetate) Water resistant. Urea Formaldehyde Free.

C. Particle Core Doors: AWI Type PC-5ME particle core doors meeting or exceeding requirements of AWI Section 1300 with ANSI A208.1, Grade 1-LD-2 particleboard core.

D. Fire Rated Doors: AWI Type FD-5. Provide fire retardant treated wood blocking inside labeled doors to receive door hardware.
   1. Furnish fire doors tested in accordance with ASTM Standard E 152 of latest issue and bearing Underwriters' Laboratories, Inc. label for fire rating required. Refer to door and frame schedule in drawings for fire rating.
   2. For 1-1/2 hour (B) and 1 hour (B) doors used in stairway enclosures the average temperature developed on the unexposed side shall not exceed 450 deg.F. at the end of 30 minutes of standard fire test exposure when tested in accordance with ASTM E152. The label attached to the door shall indicate compliance with this requirement.
   3. Positive Pressure Requirements for all doors with a fire rating greater than 20 minutes:
      a. Fire doors must comply with positive pressure testing requirements of UL 10C.
      b. Category: Provide Category "A" doors with no visible intumescents on doors or frames.
      c. Smoke Label: Certify all fire doors to comply with smoke seal requirements and apply an "S" label.

G. Face Veneers:
   1. Painted Finish: Provide "A" Grade per AWI 1300, minimum 1/50" thick face veneers using Premium Quality, Medium Density Overlay.
   2. Stained Finish: Provide "A" Grade per AWI 1300, minimum 1/50" thick face veneers using Premium Quality. Matched (pairs of doors to be Pair Matched), Slip-Running.
      a. Veneer Cut:
         1) Plain Sliced White Oak
      b. Finish stain to be custom color selected by Architect.

H. All doors occurring in a smoke partition are to have an approved, rated vision panel of not less than 100 square inches.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate wood doors complying with Contract Drawings, with this Section and with the referenced standards for types specified.

B. Prefit doors at factory with following clearances:
   1. 1/8" on top and hinge side
   2. 1/8" on lock edge of single doors
   3. 1/16" per leaf on pair meeting edges
   4. 1/2" from finished floor
   5. 3/4" max. from combustible floor
   6. 3/8" max. from non-combustible sill or threshold
   7. Bevel both edges of door (1/8" in 2"). Specific clearances to be shown on door schedule. Field trimming of fire doors will not be allowed.
   8. Seal and refinish edges that are field cut to match factory finish.

C. Pre-machine doors for hardware as required by Hardware Schedule in Bid Documents and in accordance with requirements of AWI Section 1300. Hardware Schedule by hardware supplier to be furnished complete with templates for all hardware requiring door preparation. Hollow metal frame schedule to be furnished and to include exact location and size of hardware preparation. No door machining to be required for any totally surface-mounted hardware.

3.02 FACTORY FINISH

A. Factory finish doors in accordance with requirements of AWI Section 1500 for Custom finish.
   1. Finish System: AWI Section 1500, Conversion Varnish with custom stain color to be selected by architect.
      a. Close Grain Woods:
         Washcoat
         Custom Stain
         Sealer
         Sand
         Top Coat
         Top Coat
      b. Open Grain Woods:
         Custom Stain
         Sealer
         Sand
         Top Coat
         Top Coat
   2. Apply factory finish to both faces and all edges including top and bottom of all doors.

3.03 INSPECTION

A. Examine door frames and verify frames are correct type and have been installed for proper hanging of corresponding doors.

B. Do not proceed with installation until unsatisfactory conditions have been corrected in manner acceptable to Architect.

C. Install doors only after completion of other work which would raise moisture content of doors or damage surface of doors.

3.04 INSTALLATION

A. Fit, hang, and trim doors by openings.

B. Seal cuts made on job immediately after cutting, using clear water-resistant varnish or sealer.

C. Excessive filing or grinding of strike plate will not be accepted. Filing and grinding not to exceed 1/8" in any direction.

END OF SECTION 08 14 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide doors and grilles specified including hardware, operating devices, and accessories for complete installation.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 GUARANTEE

A. Warranty provisions for Work under this Contract are specified in General Conditions. Supplementary to General Conditions, furnish written guarantee stating work is guaranteed to serve intended purpose under normal use and that defects in materials and workmanship within 1-year period after Contract substantial completion date will be repaired, replaced or made good at Contractor's expense.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide doors manufactured by Cookson, 24 Elemwood Avenue, Mountain Top, PA 18707, Tel.: (800) 233-8366 or approved equal.
   1. ASTA AMERICA by Janus International, 800-423-0659.
   1. Clopay Commercial Door Products, 800-225-6729.
   2. Raynor Worldwide, 888-598-4790.
   3. Wayne-Dalton, 855-493-3667.
   4. Overhead Door Corp., Dallas, Texas, 1-800-275-3290

2.02 INSULATED ROLLING SERVICE DOORS

A. Provide Thermiser® Max Model ESD30 Rolling Service Doors, face-of-wall mounted, as manufactured by Cookson. Telephone: (800) 233-8366.

B. Curtain: Air infiltration rate of less than .3 CFM/FT2, as tested per ASTM E283 validated by an independent testing agency.
   1. Fabrication:
      a. Slat Material: No. 6F, (Listed Exterior/Interior):
         1) Galvanized Steel/Galvanized Steel: Manufacturer recommended gauge based on performance requirements. Minimum 24/24 gauge, Grade 40, ASTM A 653 galvanized steel zinc coating.
      b. Insulation: 7/8 inch foamed-in-place, closed cell urethane
      c. Total Slat Thickness: 15/16 inch
      d. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84
      e. R-value: 8.0
      f. STC Rating: Sound Transmission Class (STC) rating up to 30 for the curtain and up to 22 for the entire assembly. If an STC of 32 is desired, additional options are required. All configurations are evaluated per ASTM E90 and based on testing a complete, operable assembly
   2. Exterior Slat Finish:
      a. Atmoshield® Powder Coating System (Color Selected by Architect):
         1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat
   3. Interior Slat Finish:
      a. Atmoshield® Powder Coating System (Color Selected by Architect):
         1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat

C. Bottom Bar:
   1. Configuration:
      a. Insulated Bottom Bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge. Minimum 4" tall x 1-1/16" thickness.
   2. Finish:
      a. Exterior: Match slats
      a. Interior: Powder coat to match slats

D. Guides:
   1. Fabrication:
      a. Thermal break required. Minimum 3/16 inch structural steel angles. Provide windlock bars of same material when windlocks are required to meet specified wind load. Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides.

Provide removable guide stoppers to prevent over travel of curtain and bottom bar.

E. Counterbalance Shaft Assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

F. Brackets: Fabricate from minimum 3/16 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures
1. Finish:
a. Atmoshield® Powder Coating System (Color Selected by Architect):
1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat

G. Hood: Minimum 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch steel intermediate support brackets as required to prevent excessive sag.
1. Finish:
a. Atmoshield® Powder Coating System (Color Selected by Architect):
1) ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat

H. Weatherstripping:
1. Bottom Bar:
a. Motor Operated Doors: Sensing/weather edge with neoprene astragal extending full width of door bottom bar
2. Guides: Replaceable vinyl strip on guides sealing against both sides of curtain
3. Lintel Seal: Double brush seal with EPDM sandwiched between the two brush seals at door header to impede air flow.

I: Electric Operation: Provide UL listed electric operator, Cookson Model EverGard Operator, Electric Motor Operator with back-up power control box
1. Entrapment Protection: Electric Sensing Edge with concealed wire reel. Exposed coiled wire is unacceptable.
2. Operation Controls: Push Button operated control stations with open, close and stop buttons for surface mounting at interior. Also, provide surface mounted key operated switch with open, close and stop positions where indicated at exterior of doors.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates and conditions under which overhead rolling doors are to be installed. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install door and operating equipment, complete with necessary hardware, jamb and head mold strip, anchors, inserts, hangers, and equipment supports complying with final Shop Drawings, and manufacturer's installation instructions.

3.03 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.04 CLEANING

A. Clean surfaces soiled by work as recommended by the manufacturer.

B. Remove surplus materials and debris from the site.

3.05 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.

B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION 08 33 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Upward Acting Sectional Steel Doors, including unit sections, brackets, tracks, glazing, counter balance mechanisms, and hardware.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 GUARANTEE

A. Warranty provisions for Work under this Contract are specified in General Conditions. Supplementary to General Conditions, furnish written guarantee stating work is guaranteed to serve intended purpose under normal use and that defects in materials and workmanship within 1-year period after Contract substantial completion date will be repaired, replaced or made good at Contractor's expense.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide doors manufactured by Clopay® Commercial Door Products, (800) 225-6729, Model 3720 or approved equal. Contact Shawn McCormick, (800) 233-8366, Ext 4632
   1. Overhead Door Corp., Dallas, Texas, 800-887-3667
   2. Raynor Worldwide, 888-598-4790.
   3. Wayne-Dalton, 855-493-3667.
   4. Cornell Innovative Door Solutions, 877-640-8825.

2.02 MATERIAL / CONSTRUCTION

A. Type: 2” thick, sandwich construction, roll-formed commercial steel.

B. Size: Standard maximum door size is 26'2" wide by 20' high.

C. Section Joint: Sections to form a weather-tight tongue and groove joint.

D. Material : Hot-dipped galvanized, complying with ASTM A-924, A-653, exterior and interior skins separated to form thermal break and filled by foamed-in-place polyurethane core; standard lift operating style with track and hardware; complying with DASMA 102, commercial application.

E. Finish: Pre-finished interior and exterior skins with 1-mil, three coat baked-on polyester topcoat over primer on a phosphate coating.
   1. Exterior Skin: 27 gauge (.016", minimum) exterior steel face sheet with stucco texture, shallow U-ribbed. Color: white or brown.
   2. Interior Skin: 27 gauge (.016", minimum) interior steel face sheet with stucco texture, shallow U-ribbed. Color: white

2.03 RELATED DOOR COMPONENTS

A. End Stiles: Galvanized steel. Attachment hardware to have pre-punched holes.
   1. 16 gauge (.056", minimum) double end hinge style.

B. Hinge and Roller Assemblies: Hinges and brackets to be 14 gauge (.070", (1.78 mm) minimum) galvanized steel.
   1. Ten-ball steel rollers to be full-floating ball bearing in case hardened steel races and mounted to fit the taper of the track.

C. Hinge Back-up Plate: 19 gauge (.034", minimum) galvanized steel.
   1. Located at the top and bottom on the inside of each section.
   2. 2" x 3" plates spaced at 44" o.c.

2.04 INSULATION

A. 2" Foamed- In-Place Polyurethane: R-value = 17.2, U-value = .058

2.05 TRACKS

A. Horizontal Track: To be 14 gauge (.075", minimum) galvanized steel reinforced with 13 gauge (.085", minimum) galvanized steel angles.

B. Rolled Galvanized Steel (select one): Standard lift track, vertical lift track, high lift track, follow-the-roof slope track, low headroom track provide: 2" or 3" as required.

C. Vertical Tracks: To be 16 gauge (.060", minimum) galvanized steel, tapered and mounted for wedge type closing.

D. Mounting: Interior face mounted on a prepared surface.

E. Track Mounting (select one):
   1. Bracket Mounting: Galvanized steel mounting brackets 12 gauge (.101", minimum) thick for wood jambs.
   2. Continuous or Reverse Galvanized Steel Angle Mounting: 12 gauge (.101", minimum) angle for steel jambs; splice plates 12 gauge (.101", minimum).

2.06 SPRING COUNTERBALANCE

A. Springs: Shall be torsion type, low stress, helically wound, oil-tempered spring on a galvanized steel tube or solid steel shaft. Wire to provide 10,000 cycles minimum.

B. Cable Drums: Die cast aluminum.

C. Cable: Pre-formed galvanized steel aircraft cable to provide a minimum of a 7:1 safety factor.

2.07 OPERATION

A. Operation Shall Be: Motor operated.

B. Inside and outside roll-grip handle.

2.08 WEATHER-STRIPPING

A. Section Joint Seal Tape: Neoprene foam seal, one-piece full length between joint of sections.

B. Field Installed Jamb/Header Weather-stripping: Extruded vinyl, placed in moderate contact with outside of door sections

2.09 BOTTOM SECTIONS

A. Astragal Retainer: Full length of section, .040" aluminum.

B. Astragal: 3-1/2" co-extruded U-shaped flexible PVC vinyl.

C. Step Plate / Lift Handle: Horizontal steel step plate / lift handle to be located on bottom section.

2.10 LOCKING

A. Inside spring loaded slide bolt lock on end stile to securely engage slot in track.
   1. Optional – Four point cylinder lock with L-handle and a single lock bar.

2.11 OPTIONS

A. Glazing:
   1. Window Size:
      a. 48" x 24"

   2. Frame to be rigid PVC.
      a. Glass Available:
         1) 1/2" Insulated glass
         2) 1/2” Insulated Tempered glass
   3. Full View Aluminum Sash
      a. Glass Available:
         1) 1/2" Insulated glass

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that dimensions are correct and project conditions are suitable for installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation: To be by an authorized Clopay representative and in accordance with manufacturer’s instructions and standards.

B. Submit manufacturer’s product data and sectional upward acting door. Include both published data and any specific data prepared for this project.

END OF SECTION 08 36 13

PART 1 - GENERAL

1.01 SCOPE

A. Provide aluminum doors, framing and hardware specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Fabricate exterior door and frame units to withstand the wind pressure loading shown or, or if not shown, 20 lbs. per sq. ft. on the gross area of the frames, doors, panels and glass, acting inward and also outward.

1.05 WARRANTY

A. Submit a warranty signed by the manufacturer, contractor, installer, agreeing to replace aluminum doors, windows, framing and glazing which fail in materials and workmanship within 2 years of the date of acceptance. Failure of materials or workmanship shall include, but not be limited to, failure in operation of doors, windows, and hardware, excessive leakage of air infiltration, excessive deflections, delamination of panels, deterioration of finish or metal in excess of normal weathering, and defect in accessories, weatherstripping, and other components of the work.
   1. Submit Extended 5-year warranty on anodized finish.

1.06 ADJUSTMENT

A. After installation, make adjustments as necessary to insure proper operation of all hardware items.

B. Door Opening Force: In accordance with the Americans With Disabilities Act (ADA), adjust all door hardware so that the maximum force required for pushing or pulling open a door shall be as follows:

1. Fire doors shall have the minimum opening force allowable by the appropriate administrative authority.
2. Exterior hinged doors: 8.5 lbf
3. Interior hinged doors: 5.0 lbf
4. These forces do not apply to the force required to retract latch bolts or disengage other devices that may hold the door in a closed position.

C. Door Closer: If door is equipped with a closer, then the sweep period of the closer shall be adjusted so that from an open position of 70°, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers who produce products that may be submitted to Architect for review are:
1. Kawneer (Basis-of-Design)
2. Oldcastle Building Envelope (OBE)
3. Tubelite
4. YKK AP America Inc.
5. EFCO
6. Approved equal

2.02 SWINGING GLASS DOORS

A. Kawneer Model 350, or approved equal, medium width stile, single acting, sizes as indicated, complete with all hardware, except cylinders.

Material Standard: ASTM B 221; 6063-T6 alloy and temper.

1. The door stile and rail face dimensions of the 350 entrance door will be as follows:

Door	Vertical Stile	Top Rail	Mid Rail	Bottom Rail
350	3-1/2"	3-1/2"	NA	10" (to meet ADA)

2. Major portions of the door members to be 0.125" nominal in thickness and glazing molding to be 0.05" thick.

B. Door Corner Warranty Period: Limited Warranty shall begin in no event later than six months from date of shipment. In addition, welded door corner construction shall be supported with a LIMITED LIFETIME WARRANTY for the life of the door under normal use.

D. Finish:
1. Clear Anodic Coating, Class 1: AAM10C22A41 clear anodized coating complying with AAMA 607.1, 0.7 mil thick minimum.

2.03 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic® AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating Color #14 Clear

2.04 HARDWARE

A. Provide hardware by Kawneer Co., or approved equal products from aluminum door and frame manufacturer's standard selections, subject to Architect's review.
   1. Push Bars: Refer to Hardware Schedule.
   2. Pulls: Refer to Hardware Schedule.
   3. Threshold: Refer to Hardware Schedule.
   4. Pivots: Manufacturer's standard, top and bottom offset pivots. Provide intermediate pivots if required due to door size/weight.
   5. Closers: Refer to Hardware Schedule.
   6. Locks: Refer to Hardware Schedule.
   7. Panic Devices: Refer to Hardware Schedule.
   8. Integrated Security Components: Refer to Hardware Schedule.
   9. Door Bottoms: Refer to Hardware Schedule.
   10. Cylinders: Refer to Hardware Schedule.
   11. Removable Mullions: Refer to Hardware Schedule.

B. All exit devices, door closers, mullions, continuous hinges and cylinders will be furnished under Section 08 71 00 - Finish Hardware, and furnished to the aluminum door supplier for installation either at the factory or on site.

C. Recommendation: Door frames should have fixed or surface-applied door stops to avoid any issues with installing electric strikes and door closers in lieu of snap-in type door stops.

2.05 FRAMING

A. Curtain Wall: Provide standard shapes and moldings of Kawneer 1600 Wall System®1 glazed framing system or approved equal.
   1. Front Set

B. Finish:
   1. Clear Anodic Coating, Class 1: AAM10C22A41 clear anodized coating complying with AAMA 607.1, 0.7 mil thick minimum.

C. Aluminum Sheet Breakmetal: Provide 3003-0 alloy.

2.06 ALUMINUM FLASHING MATERIAL

A. Aluminum Sheet: Provide 3003-0 alloy for all related flashing.

B. Finish:
   1. Clear Anodic Coating, Class 1: AAM10C22A41 clear anodized coating complying with AAMA 607.1, 0.7 mil thick minimum.

2.07 OTHER MATERIALS

A. Provide all other materials, not specifically described but required for a complete, weathertight, and proper installation of doors, windows, and framing systems, subject to acceptance by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in compliance with manufacturer's recommendations and accepted shop drawings. Set units plumb, level and true to line, without warp or rack of framing, windows, and doors. Anchor securely in place. Secure to structure with non-staining, non-corrosive shims, anchors, fasteners, spacers, and fillers. Use care in erection so as not to mar, abrade, or stain finished surfaces. Where aluminum is to be placed in contact with steel, concrete and other dissimilar surface, back paint the aluminum before erection with an acceptable bituminous paint.

B. Seal frames with a Silicone approved sealant in color to match frames, making a neat fully weatherproof job. Refer to Section 07 92 00, and comply with requirements of that section.

C. Protection: After erection, adequately protect by masking, light motor oil, vaseline or other acceptable covering all exposed parts of the work and the finish from damage by grinding and polishing machines and/or by plaster, lime, cement, acid or other harmful substances.

D. Cleaning: After completion of all other work in the vicinity of the aluminum doors, windows, and framing, remove all masking, vaseline and/or other covering used to protect the work, and thoroughly clean the aluminum surfaces with soap and plain water or a petroleum product such as white gasoline, kerosene, or distillate. Do not use abrasive cleaning agents.

END OF SECTION 08 41 13

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install aluminum curtain wall with glass specified.

B. It is the curtain wall manufacturer's responsibility to perform the following:
   1. Design and provide all curtain wall support brackets, attachments and support steel as necessary to fully support all curtain wall systems as required by drawings and specifications.
   2. Design and provide expansion and contraction capabilities for all curtain wall system.
   3. All curtain wall systems shall be designed by a structural engineer, licensed in the State of Arkansas.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Submit for approval, structural calculations for all work of this section. Comply with current design rules of the Aluminum Association, AISC, AISI and ACI. Include analysis for wind and dead load on framing members, anchors and concrete inserts. Show section property computations for framing members and submit full size die drawings. Existing test reports are not an acceptable substitute for calculations. In no case shall glass be considered as a lateral brace for framing members.
   2. When calculating members with a thermal break, calculations shall be conducted as if the aluminum sections on either side of the thermal break are additive sections, not a composite section. At the manufacturer's option, calculations can be submitted with composite action type members, if and only if, physical testing is conducted by an independent laboratory on the actual framing members being calculated and if a complete stress analysis is conducted on the thermal break material.
   3. Glass Analysis: Submit for record only, glass manufacturer's wind and snow pressure analysis and thermal analysis showing that the specified maximum probabilities of breakage are not exceeded.

4. Suitability For Structural Silicone Glazing: Submit for record only, glass manufacturer's written statement that any insulated glass, reflective glass and spandrel glass which is supported by structural silicone is suitable for such application.
5. Silicone Adhesion Tests: Submit for record only, sealant manufacturer's test reports for structural silicone and weather seal silicone adhesion to all relevant substrates. Tests must include seven day water immersion after which silicone must have excellent adhesion to substrates. Report adhesion to substrates. Report adhesion strength in terms of shear stress and tensile stress. Test samples shall approximate sealant joint sizes and configurations intended for production materials.
6. Structural Silicone Substrate Tests: Submit for record only, written test reports showing that for each condition using structural silicone, a minimum of six samples have been loaded for a minimum of one minute so as to produce a nominal stress on the silicone of 120 psi. Prior to load tests, all samples must be subjected to water immersion for seven days. Apply the load in such a manner that the force per linear inch generated by 120 psi silicone stress is transferred through all elements in the sandwich, including insulated glass edge seals. All six samples of each set must withstand the specified loading with no failure of any element. Failure of any one sample requires a new set of six samples to be tested. Apply load in 20 psi. increments held for a minimum of one minute each.
7. Show clearly on shop drawings where and how manufacturer's system deviates from contract drawings and these specifications.
8. Architect reserves right to require fabrication samples showing prime members, joiner, anchorage, expansion provisions, glazing and similar details, profiles and intersections.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 PRODUCT HANDLING

A. Protection: Protect curtain wall components, glass, and glazing materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

1.05 PERFORMANCE REQUIREMENTS

A. Minimum wind design pressures (PSF), both inward and outward and acting perpendicular to glass and panels (including return surfaces), shall be as follows:

HEIGHT	TYPICAL WALL
0-50 ft.	20
51-200 ft.	25

B. Dead load is actual weight of materials.

C. Limit deflections and stresses as follows:
   1. Normal to the plane of glass and panels, deflection of framing members is not to exceed L/175 for spans up to 13'-6" & L/240 + ¼" for spans over 13'-6" tall. Where a sealant joint occurs between a framing member and a relatively stiff building element, deflection of the framing member shall not exceed 1/2 of the joint width or less if required by sealant manufacturer.
   2. In the plane of glass and panels, deflection of framing members shall not reduce the glass or panel edge clearance below 25% of the design dimension or 1/8", whichever is greater. Restrict deflection further if required for assembly and fit of components.
   3. At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 1/16". Where connection points are not clearly defined, maximum anchor deflection shall not exceed 1/16".
   4. Stresses shall not exceed the allowable values established by the specifications. In no case shall allowable values exceed the yield stress. For load combinations, a reduction in load or increase in allowable stress (but not both) may be permitted only if permitted by code.
   5. Tensile or shear stress in structural silicone sealant joints shall not exceed 20 psi. or less if required by sealant manufacturer. In no case shall structural silicone be used to support glass or panel dead load in shear. Where structural silicone supports wind pressure in tension and shear, the shear contribution shall be neglected.

D. At 1-1/2 times design pressure, net permanent deflections of framing members must not exceed 1/1000 of span length and components must not experience failure, gross permanent distortion or disengagement or glass breakage. At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 1/8" and permanent set shall not exceed 1/16". Where connection points are not clearly defined, maximum anchor deflection and permanent set shall not exceed 1/8" and 1/16" respectively.

E. Provide clearance for thermal movement for a minimum 100 degrees F. material temperature increase and decrease. Provide additional clearance as required to accommodate erection tolerance. All components including adhesives and sealants must be able to withstand the specified temperature change with simultaneous wind and snow loads.

F. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft2 at a static air pressure differential of 6.24 psf.

G. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 15 psf as defined in AAMA 501.

H. Perform test of structural performance in accordance with NAAMM TM-1-68T, Section 4.6. Deflection limitations are listed above.

I. After test for structural performance, apply pre-load of positive 3/4 times design pressure and zero all gages. Apply a positive pressure of 1-1/2 times design pressure and record deflections and permanent sets. Performance criteria are listed above. Repeat for negative 3/4 and negative 1-1/2 times design pressure.

J. The general method of water leakage control shall be internal gutters which are drained to the exterior. Vertical walls which consist solely of glazed openings shall have an isolated gutter cavity at each glass perimeter so that any leakage is confined to and weeped from the opening of leakage origin.

K. Testing Sequence for Curtain Wall:
1. Air Infiltration
2. Static Water Infiltration
3. Dynamic Water Infiltration
4. Structural Performance at Design Pressure
5. Structural Performance at 1-1/2 Times Design Pressure

L. Glass Performance: Wind pressure is assumed to have a one minute duration. Snow pressure is assumed to have a one week duration. Upon first application of design wind and snow pressures for the specified durations, probability of breakage shall not exceed 8/1000 for vertical glass and 1/1000 for horizontal and sloped glass. An exception is glass tested to 1.5 times design pressure in a mock-up; probability of breakage shall not exceed 20/1000. Probability of breakage relative to glass thermal stress shall not exceed 8/1000 for vertical glass and 1/1000 for horizontal or sloped glass.

M. Structural Silicone Assembly Performance: Structural silicone must have an ultimate strength of at least 120 psi in tension and shear. The force per linear inch generated by this stress must be transmitted without failure by paint films, insulated glass edge seals, laminated glass interlayers, laminated panel cores, glass frits, glass scrims, glass coatings and all other elements in the line of stress.

N. Field Adhesion Tests of Sealants: Periodically check sealants in place for adhesion using methods recommended by sealant manufacturer. Promptly replace any sealant which fails to develop proper adhesion or which fails to cure.

O. Cladding system must provide for manufacturing tolerances, setting tolerance, column settlement and beam deflections. The structural engineer will quantify dead load deflection, live load deflection, long term creep deflection and differential column settlement. The deflections are not necessarily uniform from floor to floor and do not necessarily occur at the same time. Structural design considerations shall be 1/4" column settlement over 30' structural bay, 1/4" mid-span live load deflection and 4/10" lateral drift (average over entire height of building) floor to floor.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer who has had successful experience with installation of the same or similar systems required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed performance requirements.

C. Source Limitations: Obtain aluminum curtain wall system through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sight-lines, to one another, and to adjoining construction.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submissions and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for type(s) of curtain wall elevation(s) indicated, in location(s) shown on Drawings.

1.07 WARRANTY

A. Submit written warranty agreeing to repair or replace defective materials and workmanship during the warranty period as follows:
   1. Submit Extended 5-year warranty on anodized finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers who produce products that may be submitted to the Architect for review are:
   1. Kawneer 1600 Wall System™1 Curtain Wall **(Basis-of-Design)**
      a. Frame depth options: 2-1/2" x 6", outside glazed, outside glazed pressure plate format, with 1" insulating glass and 1/4" monolithic glazing.
   2. Oldcastle BuildingEnvelope™
   3. Tubelite®
   4. YKK AP America
   5. Approved equal

2.02 MATERIALS

A. Extrude aluminum components from 6063-T-5 aluminum alloy. Provide a minimum nominal wall thickness of 1/8" for structural members and 1/16" for non-structural members. Standard commercial tolerances, as listed in "Aluminum Standards and Data", shall apply to finished, fabricated and assembled materials.

B. Finishes:
   1. Clear Anodic Coating, Class 1: AAM10C22A41 clear anodized coating complying with AAMA 607.1, 0.7 mil thick minimum.

2.03 GLAZING MATERIALS

A. Gaskets and Weatherstrips except at Structural Silicone Glazing:
   1. Provide sponge gaskets of extruded black neoprene with a Shore A hardness of 40 conforming to ASTM C509. Gaskets to allow 20-35% compression.
   2. Provide dense gaskets of extruded black neoprene with a Shore A hardness of 75 for hollow profiles and 60 for solid profiles and conforming to NAAMM SG-1-70.

B. Gaskets at Structural Silicone Glazing: Provide black, non-cured silicone rubber. Use Type 1 where adhesion is not desired and Type 2 where adhesion is desired.

C. Setting Blocks:
   1. Provide black solid extruded neoprene with a Shore A hardness of 85, minimum length of 4" and a minimum width corresponding to the glass thickness. Locate at quarter points.
   2. Extruded silicone setting blocks are required where in contact with silicone sealant.
   3. Shims are to be of same material, hardness, length and width as setting blocks.

D. Side Blocks:
   1. Locate side blocks within upper half of each jamb for each light. Blocks shall have Shore A hardness of 55 and shall be solid neoprene. Install with 1/8" clearance between block and bearing surface.
   2. Side blocks are not required when an individual glass light is continuously sealed with silicone at two or more edges.

E. Lockstrip Gaskets:
   1. Lockstrip gaskets shall be spline-type extruded black neoprene with a Shore A hardness of 75 and conforming to ASTM C542.
   2. Lip seal pressure shall be a minimum of 4 lb./linear inch and a maximum of 10 lb./linear inch.
   3. Prior to installing the locking strip, apply a perimeter bead of silicone sealant between the inside surface of the glass and the lockstrip gasket.

2.04 MISCELLANEOUS MATERIALS

A. All screws, bolts, nuts, washers and rivets shall be 300 Series, non-magnetic stainless steel or cadmium plated steel.

B. Provide lock washer or other locking device at all bolted connections.

C. All hot rolled steel shapes and plates shall conform to ASTM A26.

D. Provide weep hole filters of 45 pore/inch, open cell, urethane foam compressed 30-50%.

2.05 SEALANTS

A. Shop Applied: Provide GE Silpruf or Dow Corning 795 shop applied silicone sealant, or approved equal.

B. Field Applied:
   1. Structural sealant for glazing perimeter shall be GE 1200, Dow Corning 999, or approved equal.
   2. For other joints, select an appropriate sealant for the type of joint, movement and substrates involved. Acceptable products include Tremco Dymeric, GE 1200, Dow Corning 999, GE Silpruf, Dow Corning 795, Tremco Curtainwall Sealant, Dow Corning 790, PTI 606 Butyl Tape, Tremco Polyshim Tape, or approved equal.

2.06 ALUMINUM SUB-SILL FLASHING

A. Aluminum window and framing supplier is to provide aluminum sub-sill flashing "pans" of same aluminum alloy as frames and of minimum .050" thickness. Form pans by turning up ends and interior side 1/2". Lap end splices minimum of 2". Apply sealant to lap and rivet at 2" o.c. maximum. Provide in maximum length possible to minimize number of splices. Apply bituminous paint to concealed surfaces in contact with dissimilar metal, concrete or mortar. Set sub-sill in continuous bed of sealant and seal around all anchors penetrating sub-sill. Do not anchor window sill through sub-sill. Finish to match aluminum frame.

2.07 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic® AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear) (Optional)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install complete with components set plumb, square, level, at their proper elevation and plane, and located in proper alignment with all work. Protect exposed aluminum from damage by grinding and polishing
machines, lime, acid, cement, and harmful compounds.

B. Erection Tolerances: Adjust work to conform with the following tolerances.
1. Plumb: 1/8" in 10'; 1/4" in 40'.
2. Level: 1/8" in 20'; 1/4" in 40'.
3. Limit offset of member alignment to 1/16" where surfces are flush or less than 1/2" out of flush and seperated by less than 2"; otherwise limit offsets to 1/8".
4. Location: 3/8" maximum deviation from measured theoretical location.

C. Firestopping "Safing" Insulation: Clean debris from behind window wall during erection and provide temporary closures to prevent accumulation. Install firestopping to comply with governing regulations and with AAMA RI-A3. Install firestopping with securely anchored metal flanges or equivalent provisions to prevent dislocation.

3.02 CLEANING

A. Clean aluminum and insulating panels. Clean aluminum thoroughly with plain water or solvent recommended by curtain wall manufacturer. Do not use abrasive cleaning agents. Contractor responsible for damages resulting from use of cleaning materials.

END OF SECTION 08 44 13

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets.
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. "Metal Doors and Frames"
   b. "Flush Wood Doors"
   c. "Aluminum-Framed Entrances and Storefronts"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature

4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

3. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.

3) Name and manufacturer of each item.
4) Fastenings and other pertinent information.
5) Location of each hardware set cross-referenced to indications on Drawings.
6) Explanation of all abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for hardware.
8) Door and frame sizes and materials.
9) Degree of door swing and handing.
10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

4. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule
   e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. Fire door assemblies, in compliance with NFPA 80.
   b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Architect and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.

B. Certifications:

1. Fire-Rated Door Openings:
   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
   b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:
   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
   b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
   a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.

3) Requirements for key control system.
4) Requirements for access control.
5) Address for delivery of keys.

2. Pre-installation Conference
   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.06 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
   a. Mechanical Warranty
      1) Locks
         a) Falcon: 10 years
      2) Exit Devices
         a) Falcon: 10 years
      3) Closers
         a) Falcon SC Series: 10 years
   b. Electrical Warranty
         a) Falcon: 1 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."

1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Ives 5BB series

2. Acceptable Manufacturers and Products:
   a. Hager BB1191/1279 series
   b. McKinney TB series
   c. Best FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high

b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Rockwood
   b. Trimco
   c. Hager

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.05 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Falcon MA series

2. Acceptable Manufacturers and Products:
   a. Schlage L series
   b. Corbin-Russwin ML2000 series
   c. Sargent 8200 series
   d. Best 40H series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.

2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

2.06 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Falcon T series

2. Acceptable Manufacturers and Products:
   a. Schlage ND series
   b. Corbin-Russwin CL3300 series
   c. Sargent 10-Line
   d. Best 9K series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Falcon 24/25 series

2. Acceptable Manufacturers and Products:
   a. Sargent 19-43-GL-80 series
   b. Precision Apex series
   c. Von Duprin 78/75 series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer's approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrified options as scheduled.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.08 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer:
   a. Falcon

2. Acceptable Manufacturers and Products:
   a. Best
   b. Corbin-Russwin
   c. Sargent

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer’s series as indicated. Refer to “KEYING” article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
   a. Open: cylinder with small format interchangeable core (SFIC) core with open keyway
   b.

2.09 KEYING

A. Scheduled System:

1. New factory registered system:
    a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
    a. Replaceable Construction Cores.
        1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
            a) 3 construction control keys
            b) 12 construction change (day) keys.
        2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:
    a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
        1) Master Keying system as directed by the Owner.
    b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
    c. Provide keys with the following features:
        1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
    d. Identification:
        1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
        2) Identification stamping provisions must be approved by the Architect and Owner.
        3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
        4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
        5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
    e. Quantity: Furnish in the following quantities.
        1) Permanent Control Keys: 3.
        2) Master Keys: 6.
        3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
        4) Key Blanks: Quantity as determined in the keying meeting.

2.10 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
    a. Telkee

2. Acceptable Manufacturers:
    a. HPC
    b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.11 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
    a. Falcon SC70A series

2. Acceptable Manufacturers and Products:
    a. LCN 4050 series
    b. Norton 7500 series
    c. Sargent 351 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.12 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
    a. Ives

2. Acceptable Manufacturers:
    a. Hager
    b. Trimco
    c. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.13 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Hager
   b. Trimco
   c. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
   a. Glynn-Johnson

2. Acceptable Manufacturers:
   a. Rixson
   b. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Hager
   b. Trimco
   c. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Zero International

2. Acceptable Manufacturers:
   a. National Guard
   b. Reese
   c. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.17 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

2. Acceptable Manufacturers:
   a. Hager
   b. Rockwood
   c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.18 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.

M. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

Hardware Sets: OPT0400445 – 20250213RH

HARDWARE GROUP NO. 000

FOR USE ON DOOR #(S):
104B 105B 116B

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR

-CASED OPENING. NO HARDWARE REQUIRED.

HARDWARE GROUP NO. 001

FOR USE ON DOOR #(S):

100A	100B	100C	100E	100G	100H
102A	103A	104A	116D	116E	116F
125B	125C				

PROVIDE EACH RU DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	C987 AS REQ	626	FAL
1	EA	SFIC CORE	C607	626	FAL

-BALANCE OF HARDWARE BY OVERHEAD DOOR MANUFACTURER.
-COORDINATE CYLINDER REQUIREMENTS WITH OVERHEAD DOOR MANUFACTURER.
-REMOVE CYLINDER AND CORE IF NOT REQUIRED.

HARDWARE GROUP NO. 103T

FOR USE ON DOOR #(S):

109A	110A	117A	118A	119A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRY LOCK	T501H7 QUA	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 105

FOR USE ON DOOR #(S):

125A	125D

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	ENTRY LOCK	T501H7 QUA	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	GASKETING	188S (HEAD & JAMBS)	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

HARDWARE GROUP NO. 203

FOR USE ON DOOR #(S):
101A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 203T

FOR USE ON DOOR #(S):
111A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 205T

FOR USE ON DOOR #(S):
104C

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	T581H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	GASKETING	188S (HEAD & JAMBS)	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

HARDWARE GROUP NO. 210T

FOR USE ON DOOR #(S):
202

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	T581H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A RW/PA (ACTIVE)	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	ASTRAGAL	ACTIVE LEAF Z ASTRAGAL BY HMD MANUFACTURE		
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 214

FOR USE ON DOOR #(S):
106A

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	T581H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	OH STOP	90S X SIZE AS REQ (INACTIVE)	630	GLY
1	EA	SURFACE CLOSER	SC71A SS (ACTIVE)	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	GASKETING	188S (HEAD & JAMBS)	BK	ZER
1	EA	ASTRAGAL	ACTIVE LEAF Z ASTRAGAL BY HMD MANUFACTURE		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

HARDWARE GROUP NO. 341T

FOR USE ON DOOR #(S):
112A 113A 120A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S SPA OS-LOC	626	SCH
1	EA	SURFACE CLOSER	SC71A REG	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 501C

FOR USE ON DOOR #(S):
108A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	T561H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 503T

FOR USE ON DOOR #(S):
115A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	T561H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	WALL STOP	WS406/407CCV	630	IVE

HARDWARE GROUP NO. 510CT

FOR USE ON DOOR #(S):
102B 103B

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	T561H7 DAN	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	OH STOP	90S X SIZE AS REQ (INACTIVE)	630	GLY
1	EA	SURFACE CLOSER	SC71A SS (ACTIVE)	689	FAL
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	ASTRAGAL	ACTIVE LEAF Z ASTRAGAL BY HMD MANUFACTURE		
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 785T

FOR USE ON DOOR #(S):
105A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-25-R-L-NL-DANE	626	FAL
1	EA	MORTISE CYLINDER	C987 AS REQ	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	GASKETING	188S (HEAD & JAMBS)	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

HARDWARE GROUP NO. 801T

FOR USE ON DOOR #(S):
114A 114B 121A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16" F	630	IVE
1	EA	SURFACE CLOSER	SC71A RW/PA	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. C205T

FOR USE ON DOOR #(S):
100D 100F

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	EU STOREROOM LOCK	MA881-RX-H DG CON (FAIL SECURE)	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	GASKETING	188S (HEAD & JAMBS)	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (IN FRAME)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY LEVER.

HARDWARE GROUP NO. C715A

FOR USE ON DOOR #(S):
107A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-MEL-24-R-NL-OP	626	FAL
1	EA	SFIC RIM CYLINDER	C953	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	MOUNTING PLATE	SC70A-18PA	689	FAL
1	EA	CUSH SHOE SUPPORT	SC70A-30	689	FAL
1	EA	BLADE STOP SPACER	SC70A-61	689	FAL
1	SET	GASKETING	PERIMETER SEAL BY ALUM FRAME MANUFACTURER		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (IN FRAME)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PANIC HARDWARE.

HARDWARE GROUP NO. C785T

FOR USE ON DOOR #(S):
116A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	LD-FSE-25-R-L-DANE	626	FAL
1	EA	MORTISE CYLINDER	C987 AS REQ	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	SC71A SS	689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	GASKETING	188S (HEAD & JAMBS)	BK	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (IN FRAME)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		
1	EA	DOOR POSITION SWITCH	BY SECURITY CONTRACTOR		
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PANIC HARDWARE.

END OF SECTION 08 71 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install glass and glazing materials and accessories for both factory and field glazed assemblies specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Samples:
1. Size: 305 mm by 305 mm (12 inches by 12 inches) of each type specified.
2. Tinted glass.
3. Reflective glass.
4. Transparent (one way vision glass) mirrors.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Provide at least one person thoroughly trained and experienced in skills required, completely familiar with referenced standards and requirements of this work and to personally direct installation performed under this Section.

B. Applicable Standards For Glass and Glazing Work: Conform to the "Manual of Glazing" of the Flat Glass Marketing Association, requirements of Federal Specification DD-G-451c and Safety Standard 16 CFR 1201 of the U.S. Consumer Products Safety Commission.

C. Manufacturers: Fabrication processes, including low emissivity and reflective coatings, insulating, laminated, silk-screening and tempering shall be manufactured by a single manufacturer with a minimum of ten (10) years of fabrication experience and meet ANSI / ASQC 9002 1994.

1.05 APPLICABLE PUBLICATIONS

A. ANSI Z97.1-14: Safety Glazing Material Used in Building Safety Performance Specifications and Methods of Test.

B. ASTM C1036-21: Standard Specification for Flat Glass

C. ASTM C1048-12: Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

D. Code of Federal Regulations (CFR): 16 CFR 1201-10 Safety Standard for Architectural Glazing Materials.

E. International Building Code - Chapter 24: Glass and Glazing

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection: Protect glass and glazing materials before, during, and after installation. Protect installed work and materials of other trades.

B. Storage and Protection: Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

C. Replacements: In event of damage, immediately make repairs and replacements necessary and at Contractor's expense.

PART 2 - PRODUCTS

2.01 GLASS TYPES

A. No manufacturer logos are allowed on any glass, except as required by governing codes and standards. Provide certification to General Contractor that tempered, heat strengthened, annealed, laminated, etc. glass was used where required.

B. Annealed float glass shall comply with ASTM C1036, Type I, Class 1 (clear), Class 2 (tinted), Quality-Q3.

C. Heat-Strengthened float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind HS.

D. Tempered float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind FT.

E. Heat-treated glass with elastomeric coating complying with ASTM C1048, Condition C (other coated glass), Type I (transparent glass, flat), Quality Q3 (glazing select) and with other requirements as specified.

F. GANA/GTA 89-1-31, "Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifiers", and with other requirements as specified.

G. Provide type glass and thickness required and as follows:
1. **Clear Annealed Float Glass:** 1/4" thick unless otherwise shown.

2. **Clear Tempered Float Glass:** 1/4" thick unless otherwise shown. Conform to Safety Standard 16 CFR 1201 of the Consumer Products Safety Commission.

3. **Solar Control "Low-E" Coating:** Vitro Architectural Glass Solarban® 72 (2) Acuity™ + Acuity™, SHGC 0.23, Insulating Glass Unit (IGU) or approved equal.

4. **Spandrel Glass:** Heat strengthened, 1/4" polished plate/float glass, rendered opaque with a water-based silicone elastomeric spandrel coating in shade selected by Architect from manufacturer's standard color line. OPACI-COAT-300®, #2-3866LI, Color Name: Shaded Tree (LI), Outboard Glass: Acuity® + Solarban® 72 (2), Inboard Glass: Acuity®.

2.02 FIRE RATED GLASS

A. Approved Manufacturers:
1. PYRAN® Platinum L as manufactured by SCHOTT Technical Glass Solutions and distributed by SAFTI FIRST Fire Rated Glazing Solutions, 888-653-3333. **Amber-tinted glass will not be accepted.**

B. Properties:
1. Thickness: 3/8 inch overall
2. Weight: 4 lbs./sq. ft.
3. Appearance Must have neutral coloration free of amber tints.
4. Fire-rating: 20 minutes to 3 hours for doors; 20 minutes to 60 minutes for other applications, with hose stream.
5. Impact Safety Resistance: Must meet CPSC 16 CFR 1201 Category I and II.
6. STC Rating: Approximately 36 dB.
7. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.

C. Labeling: Each piece of Fire-rated glazing material shall be labeled with a permanent logo including name of product, manufacturer, testing laboratory and fire rating.

D. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E 152 and ASTM E 163; NPFA 252 and NFPA 257; UL 9, UL 10B and UL 10C.

E. Glazing Compound for Fire-rated Glazing Materials: Silicone Sealant, One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:

1. Dow Corning 795 - Dow Corning Corp.
2. Silglaze-II 2800 - General Electric Co.
3. Spectrem 2 - Tremco Inc.

F. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

G. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.03 HERMETICALLY SEALED INSULATING GLASS ASSEMBLIES

A. Manufacturer is used in this section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced standards.
1. Guardian Industries
2. Oldcastle Glass
3. Pilkington
4. Viracon Architectural Glass
5. Vitro Architectural Glass
6. Approved equal

B. Insulating glass units are certified through the Insulating Glass Certification Council (IGCC) to ASTM E 2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.

C. The following are assemblies comprised of the components listed above.
1. **Clear Annealed Float Glass:** 1/4" thick unless otherwise shown.

2. **Clear Tempered Float Glass:** 1/4" thick unless otherwise shown. Conform to Safety Standard 16 CFR 1201 of the Consumer Products Safety Commission.

3. **Solar Control "Low-E" Coating:** Vitro Architectural Glass Solarban® 72 (2) Acuity™ + Acuity™, SHGC 0.23, Insulating Glass Unit (IGU) or approved equal.

4. **Spandrel Glass:** Heat strengthened, 1/4" polished plate/float glass, rendered opaque with a water-based silicone elastomeric spandrel coating in shade selected by Architect from manufacturer's standard color line. OPACI-COAT-300®, #2-3866LI, Color Name: Shaded Tree (LI), Outboard Glass: Acuity® + Solarban® 72 (2), Inboard Glass: Acuity®.

5. **Spacers:** Aluminum in Black Finish. Verify color selection with architect before fabrication.

2.04 FLAT GLASS

A. Flat Glass:
1. Shall comply with ASTM C1036-21 Standard Specification for Flat Glass, Type 1, Class 1, (clear) or Class 2 (tinted, heat-absorbing and light-reducing) and Quality q3.

2. ASTM C 1048 Heat Treated Flat Glass, Kind HS or FT (remove ASTM Standard C 1048 if annealed glass), Condition A (un-coated), B (spandrel glass, one surface coated), or C (other coated glass).
   a. Heated Treated Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.
   b. Maximum peak-to-valley rollerwave 0.003" in the central area and 0.008" within 10.5' of the leading and trailing edge.
   c. For clear or low-iron glass 1/4" to 3/8" thick without ceramic frit or ink, maximum + or - 100mD (millidiopter) over 95% of the glass surface.
   d. Maximum bow and warp 1/32" per lineal foot.
   e. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
   f. For all fully tempered glass, provide heat soak testing conforming to EN14179 which includes a 2 hour dwell at 290°C±10°C.

2.05 GLAZING ACCESSORIES

A. Provide glazing accessories required to complete glazing work that are compatible with various components of the glazing system(s), and subject to approval of Architect.

B. Glazing Sealants: Provide Tremco "Proglaze", Bostik "Chem-Calk 2000", Pecora "836", Dow Corning Silicon 795, or approved equal. Color to be selected by Architect from manufacturer's standard line.

C. Glazing Tapes: Provide Tremco "Pre-shimmed 440", Bostik "Chem Tape 60", Pecora "Shim-Seal", or approved equal. Color to be selected by Architect from manufacturer's standard line.

D. Setting Blocks: Neoprene or other resilient blocks of 70 to 90 Shore A durometer hardness, adhesive backed on one face only and tested for compatibility with specified glazing sealants.

E. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness and tested for compatibility with specified glazing sealants.

F. Compressible Filler Rod: Closed-cell or waterproof jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% deflection), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.

2.06 ARCHITECTURAL WINDOW FILM

A. Provide Fasara™ - Opaque White SH2MA OW Decorative / Privacy Glazing Film by 3M as indicated on the drawings. Contact the authorized 3M window film dealer.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and workmanship. Finish areas to be designated by Architect. Do not proceed with remaining work until workmanship, color, and sheen are approved by the Architect. Refinish mock-up area as required to produce acceptable work.

PART 3 - EXECUTION

3.01 GLASS SIZES

A. Measure sizes for glass from actual frames, doors and windows. Contract requires glass to be set in place, and Contractor assumes responsibility for correct sizes. Use sizes shown on Drawings for estimating only as approximate dimensions.

3.02 GLAZING SURFACES

A. Glaze only dry surfaces, free from dust or ice. Clean dirty surfaces with cloth saturated with turpentine or mineral spirits before glazing. Remove loose dirt particles and mortar from recesses prior to installation of glass and glazing materials.

3.03 SETTING GLASS

A. Set glass to provide equal bearing for entire width of each pane. Contractor responsible for broken glass due to improper setting. Set using glazing stops furnished by door or fixed framing manufacturer unless otherwise shown or specified. Accurately set glass to fit frame, with all edges smooth. Sharp ragged edges are not acceptable. Cushion glass in fixed interior view windows with felt strips around entire perimeter.

3.04 CLEANING GLASS

A. Contractor shall employ services of a professional window washer at completion of all work to wash glass which has been installed under this contract, removing all stains.

B. Clean glass on both sides after painting operations are complete and dry. Do not use acid solutions or caustic soaps to clean glass.

C. Do not use razor blades to clean glass. Any scratches on the glass caused by the cleaning process will be cause for the removal and replacement of the damaged glass at the Contractor's expense.

END OF SECTION 08 80 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide metal supports and fastenings, gypsum board, and related accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Use only skilled and experienced gypsum drywall installers. Fully supervise at all times helpers and apprentices used for drywall work with thoroughly skilled gypsum drywall installers.

B. Manufacturers' Recommendations: Manufacturers' recommended use of materials, fastenings, and methods of installation is basis for acceptance or rejection of drywall and cementitious backer units work where not specifically otherwise shown or detailed.

1.05 REFERENCE STANDARDS

A. ASTM C475/C475M, Joint Compound and Joint Tape for Finishing Gypsum Board.

B. ASTM E580 - Suspension Systems in Areas Requiring Seismic Restraint.

C. ASTM C1396/C1396M, Standard Specification for Gypsum Board.

D. ASTM C36/C36M, Standard Specification for Gypsum Wallboard.

E. ASTM C840, Standard Specification for Application and Finishing of Gypsum Board.

F. ASTM C1178, Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

G. ASTM C1325, Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units. (Non-asbestos)

H. ASTM C645, Standard Specification for Nonstructural Steel Framing Members.

I. ASTM C754-04, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

J. Gypsum Association publications:
   1. GA-214-2022, "Levels of Finish for Gypsum Panel Products".
   2. GA-216-2024, "Application and Finishing of Gypsum Panel Products".
   3. GA-600-2024, "Fire Resistance Design Manual".
   4. GA-800, "Materials Handling Manual".
   5. GA-234-2019, “Control Joints for Fire-Resistance Rated Systems”

1.06 FIRE RESISTANCE RATINGS AND IDENTIFICATION

A. Where gypsum drywall systems with fire resistance ratings are indicated or are required to comply with governing regulations, provide materials and installation methods identical to applicable assemblies which have been tested and listed by recognized authorities, including Underwriters Laboratories, Warnock-Hersey and Factory Mutual.

B. All joints in fire rated gypsum board construction are required to be taped and floated. This includes all joints in concealed and exposed partitions, ceilings and other applications where gypsum board is utilized as a fire barrier. All screws are to be floated over.
   1. Do not use self adhesive Tape at fire rated construction. Provide standard Tape and Drywall Mud.

C. All rated partitions are to extend to the underside of the roof or floor deck above and are to be sealed at the point of intersection with the deck in accordance with requirements of Section 07 84 00 - Firestopping.

1.07 PRODUCT HANDLING

A. Protection: Protect gypsum drywall materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary and at Contractor's expense.

PART 2 - PRODUCTS

2.01 GYPSUM MATERIALS

A. **Manufacturers:** Use products and materials by one of the following manufacturers:

1. United States Gypsum
2. National Gypsum Company
3. Georgia-Pacific Company
4. Temple-Inland, Inc.
5. Certainteed
6. James Hardie Building Products
7. Approved Equal

B. **Gypsum Wallboard:** Conform to ASTM C1396, have tapered edges and furnished in largest practical sheet size to minimize number of joints. Provide thickness as indicated on Drawings; typically provide 5/8" thickness at walls.

C. **Backerboard for Ceramic Tile:**
1. Provide 5/8 inch DensShield® FireGuard® Tile Backer gypsum board as manufactured by Georgia Pacific Company, GlasRoc® Diamondback® Tile Backer by CertainTeed, or approved equal. Furnish largest size sheets practical to minimize joints. Conform to manufacturer's instructions for installation given the conditions detailed on the drawings. Caulk all joints where backer board comes into contact with dissimilar material.
2. Provide 5/8 inch (interior) Durock® Brand Cement Board with EdgeGuard™ protection as manufactured by United States Gypsum Co., or approved equal. Furnish largest size sheets practical to minimize joints. Conform to manufacturer's instructions for installation of cement board given the conditions detailed on the drawings. Caulk all joints where backer board comes into contact with dissimilar material.

D. **Fire Retardant Gypsum Board:** 5/8" fire retardant gypsum board conforming to UL Design Numbers listed on drawings for type and manufacturer.

E. **Glass Fiber Reinforced Gypsum Tile Backer:** Provide Georgia Pacific DensShield® Tile Backer Panels where called out on the drawings. Comply with ASTM D3273 for mold resistance. Provide fire rated units where required. Approved equal manufacturers:
1. Gold Bond® Brand eXP® Extended Exposure Sheathing.

F. **Mold & Moisture-Resistant Gypsum Panels:** Provide USG Sheetrock® Mold Tough® Panels where called out on the drawings. Comply with ASTM C1396. Provide fire rated units where required. Approved equal manufacturers:
1. CertainTeed ProRoc®
2. Georgia-Pacific ToughRock® Mold-Guard Gypsum Board
3. Gold Bond® Building Products eXP® Interior Extreme® Gypsum Board (1/2" thick) at non-fire rated wall and ceiling assemblies. Provide 5/8" thick Fire-Shield® at rated assemblies.

G. **Finish:** In general, all gypsum board walls are to be taped and floated for a smooth finish. A slight egg-shell texture may be acceptable if approved by Architect prior to application. Heavy "knockdown" texturing is not acceptable.

1. All screw and/or nail heads are to be floated smooth both above and below ceiling line.
2. Refer to Drywall Finishing Council document titled, “Recommended Specification For Preparation of Gypsum Board Surfaces Prior To Texture Application. When subjected to critical lighting, a Level 5 gypsum board finish as defined in GA-214-2021 (“Levels of Finish for Gypsum Panel Products”) is recommended.
3. For Levels 3, 4, and 5, job-site mock-up(s) shall be used to determine acceptance of the finish within the building. The design professional shall specify the mockup procedure and mock-up construction details within the project documents, unless waived in writing. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. **Use Level 4 finish for all finished areas open to public view.** Level 5 skim coating is required at areas exposed to severe lighting conditions, gloss, semi-gloss, or enamel paint applications. Refer to the drawings for specific area locations.

2.02 WALL AND PARTITION FRAMING

A. Provide type, size, gauge and physical properties as described by the manufacturers load and height tables and in accordance with the current local building code. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

B. Structural calculations specifically related to this project and performed by the manufacturer's structural engineer will indicate depths, gages and spacings of studs required to meet deflection and load bearing requirements.

C. At all instances where radius steel stud and drywall construction is shown on drawings it is intended that the radius be smooth not faceted. Contractor is required to provide smooth face radius by whatever means necessary.

D. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

E. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.
1. Screw attach blocking between studs for support of surface mounted items.
    a. Plumbing fixtures.
    b. Toilet partitions.
    c. Wall cabinets.
    d. Toilet accessories
    e. Hardware.
    f. Architectural woodwork.
    g. Grab bars.

h. Handrails and railings.
i. Signage.
j. Other items requiring backing for attachment.

2.03 METAL FURRING MEMBERS

A. "Hat" Type Channels: ASTM C 645, 25 gage minimum, hat-shaped, depth and thickness as indicated. Provide 22 gage min. Galvalume® (GVM) Vented Hat Channel (HCV) at exterior rainscreen for spacing between insulation and exterior cladding.

B. "C" Type Channels: 16 gauge, 1-1/2" deep cold rolled steel channels painted black and weighing not less than 475 lbs. per 1,000 LF.

C. Z-Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, fabricated from 26-gage galvanized steel, steel sheet complying with ASTM A 525 or ASTM A 568; with a minimum base metal (un-coated) thickness of 0.0179 inch, face flange of 1-1/4 inch, wall-attachment flange of 7/8 inch, and of depth required to fit insulation thickness indicated.

D. Furring Brackets: Serrated-arm type, adjustable, fabricated from corrosion-resistant steel sheet complying with ASTM C 645, minimum thickness of base (un-coated) metal of 0.0329 inch, designed for screw attachment to steel studs and steel rigid furring channels used for furring.

2.04 ACOUSTICAL INSULATION

A. In partitions, provide un-faced Owens-Corning Sound Attenuation Batt (SABs) Insulation, or approved equal, complying with ASTM C 665, Type I and ASTM E 136. Flame spread rating shall not exceed 25 and smoke developed shall not exceed 50 when tested complying with ASTM E 84.

2.05 DIRECT CEILING SUSPENSION SYSTEMS

A. Manufacturer: Chicago Metallic or approved equal.
1. Armstrong® Pre-Engineered FrameAll™ Drywall Grid.

B. System: Provide Chicago Metallic Drywall Furring System(s) as follows:
1. Typical System: 640-C or 660-C as recommended by manufacturer.
2. Fire Rated System: Fire front 650-C or 670-C as recommended by manufacturer.

C. Provide all runners, tees, cross channels, cross tees, wall track, hanger wire and accessories required for a complete installation.

D. Where ceiling is subject to wind uplift, provide adequate bracing above ceiling to prevent uplift.

2.06 FASTENERS

A. Drywall Screws: Self-drilling type, 1" long for single layer application of gypsum board to metal studs and furring channels and of longer length for multiple layer installation.

B. Powder-Actuated Fasteners: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Furring Anchorages: 16-gage galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer and complying with C754.

2.07 PROTECTIVE COATING

A. Galvanized steel studs, runners (track), rigid (hat section) furring channels, “Z” shaped furring channels, and resilient furring channels, with coating designation of G40 or equivalent.

2.08 ACCESSORIES

A. Casing Bead: "Goldbond" No.500 galvanized steel by National Gypsum Co., or approved equal. Furnish and install metal reveal strips where shown and detailed.

B. Corner Beads: 0.014 inch thick, hot dip galvanized steel with 1" flanges with 1/16" radius nose with large openings in flange similar to 5/8" diameter holes 7/8" on center.

C. Control and Expansion Joints: "Sheetrock" zinc control joint No.093 by USG, or approved equal. Provide safing and/or acoustical insulation behind control joints as required for adjacent partition construction. Use fire rated control joints in partitions requiring a fire rating.

2.09 ACCESS PANELS AND FRAMES

A. Manufacturer: Milcor Limited Partnership, 1150 North Cable Road, Lima, OH 45805, 1-800-528-1411, or approved equal.

B. Ceiling Access Doors (in non-rated gypsum board ceilings): Provide Milcor style "DW", Model No. 3203-019, or approved equal. Provide 24" x 24" door size with screwdriver-operated, flush, cam-type locks. Furnish with factory prime coat.

C. Wall Access: Provide 24" x 24" Model KDW Flush Access Door as manufactured by Karp Associates, Inc., 1-800-888-4212 or approved equal.

D. **Access Locations:** Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, clean-outs, and other mechanical, electrical and conveyor control items concealed in walls and partitions. Verify types, fastening and locations with architect during shop drawing review submission.
   1. When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies.
   2. Install fire-rated access doors in fire-rated partitions and ceilings in accordance with NFPA 80.

2.10 ARCHITECTURAL FIBERGLASS REINFORCED POLYESTER COLUMNS

A. Manufacturer: Edon Corp., 1-800-523-2539, or approved equal.

B. Provide Model #EC-110G, variable height, 1'-9" column diameter, 2'-3" base width, 11-3/4" base height, 2'-6" cap width, 1'-2-1/8" cap height. Internally strengthen the lower 5'-0" of the column.

C. Column covers are to be field primed and painted in color to be selected by Architect.

D. Sand columns approximately 2" on each side of the joints using #200 sandpaper. Apply masking tape vertically on the columns 2" on each side of the joints and apply multiple layers of polyester body filler over the joints and rivets to make a smooth, rounded surface.

E. Wall pilasters to be similar.

2.11 OTHER MATERIALS

A. Provide materials, not specifically described but required for complete and proper installation of gypsum drywall, selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 GENERAL PROVISIONS

A. Comply with specified requirements, manufacturer's instructions and recommendations, and referenced standards.

B. In cold weather, heat building to provide uniform temperature of 50° to 70° and provide ventilation to eliminate excess moisture.

C. Deliver materials to job in original unopened containers or bundles and store protected from damage and exposure to the elements.

D. Provide casing beads where edges of gypsum board meet dissimilar materials.

E. Cooperate with carpenters in placing of backing and blocking required for millwork, fixtures, fittings, and accessories.

F. Make cut-outs in panels for pipes, fixtures and small openings. Make holes and cut-outs by method that will not fracture wallboard core or tear covering. Cut holes with accuracy so plates, escutcheons and trim cover edges.

G. Seal cut edges, holes, and areas where wallboard covering is broken, with resistant sealer.

H. Install trim in strict accordance with manufacturers' recommendations. Install trim plumb, level, and true to line with firm attachment to supporting members.

I. At any change in direction of gypsum board, provide sufficient auxiliary framing, blocking or nailers to allow secure attachment along every edge of every individual piece of gypsum board. Do not leave any loose edges.

3.02 INSTALLATION OF METAL SUPPORT SYSTEMS

A. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

B. Ceiling Support Suspension System: Install in accordance with manufacturers recommendations.

C. Wall/Partition Support System
   1. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported on gypsum board alone.
   2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
   3. Do not attach stud system to ductwork, piping, conduit, etc.
   4. Install runners (tracks) at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.
   5. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support and substrate above the ceiling as indicated. Install angle bracing at 4'0" on center from ceiling runner to structure above.
   6. Frame door openings with vertical studs securely attached by screws at each jamb either directly to frames or to jamb anchor slips on door frame; install runner track sections (for jack studs) at head and secure to jamb studs. Install angle bracing above ceiling to structural in each direction at strike side of door. Double studs at all door openings.
   7. Provide runner tracks of same gage as jamb studs. Space jack studs same as partition studs.

8. Frame openings other than door openings in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads. Opening for duct work, piping must allow clearance for insulation, dampers, etc. Provide double 20 gauge studs at both sides of door openings less than 4'-0" wide and triple 20 gauge studs at door openings greater than 4'-0" wide.
9. Install wall/partition support system to maximum tolerances of 1/8" in 12'-0" measured horizontally and vertically.
10. At rated partitions, provide "5 sided" gypsum board enclosures where items (i.e. toilet accessories, electrical items, fire extinguisher cabinets, etc.) penetrate the surface of the wall, in order to maintain fire resistive integrity of the wall. Provide necessary related blocking.
    a. "5 sided" enclosures may be omitted where metal electrical back-boxes not exceeding 16 square inches occur at one side only of a wall within a single stud cavity.
    b. In this case, provide fire stopping material described in Section 07 84 00 to completely encompass the back box and its annular space.
    c. If 5 sided gypsum board enclosures are not to be provided at any fire rated partitions, all provisions for installation of electrical boxes in rated partitions as described by Underwriters Laboratories shall be adhered to AND prior approval shall be given in written form by the Architect.
11. Provide "5 sided" enclosures similar to those described above at all penetrations into "sound" partitions and insulated exterior walls regardless of size. The provisions for the omission of the 5 sided enclosures at certain fire rated partitions do not apply to these sound and exterior partitions.

3.03 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Pre-Installation Conference: Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

B. Install sound attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed.

C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate course of board.

D. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".

E. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Do not butt boards to concrete floor. Maintain a minimum 1/4" to a maximum 3/8" space between bottom of board and concrete.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

G. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

H. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts. Space between recessed boxes and cut edges shall not exceed 1/8 inches.

I. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories described below in article entitled "INSTALLATION OF DRYWALL TRIM ACCESSORIES".

J. Cover both faces of partition framing with gypsum board in concealed spaces (above ceilings, etc.) except in chase wall which are braced internally.

K. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

3.04 INSTALLATION OF CEILING ACCESS PANELS

A. General Contractor is required to coordinate locations and number of access panels with affected trades in order to minimize the number of access panels required.

B. Provide ceiling access panels in gypsum board ceilings as specified. Provide quantity required for access to the following items commonly found above the ceiling plain:
   1. Operable portion of fire, smoke and other dampers
   2. Valves and other operable portions of sprinkler system
   3. Valves to mechanical, domestic and other piping systems
   4. Mechanical devices
   5. Fire alarm devices
   6. Communication system devices and connection points
   7. Sanitary and storm sewer clean outs
   8. Also included are any other items located above an otherwise inaccessible ceiling that will require adjustment, maintenance, inspection, connection or replacement in whole or in part at any time after the initial installation of the item or the ceiling.

3.05 METHODS OF GYPSUM BOARD APPLICATION

A. On ceilings:
   1. Apply gypsum board prior to wall/partition board application to the greatest extend possible. For single-ply construction, use perpendicular application. For two-ply assembles use perpendicular application and apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.
   2. Where screws are used, they shall be spaced not more than 12 in. o.c. for ceilings where the framing members are 16 in. o.c..
   3. Screws shall be spaced not more than 12 in. o.c. for ceilings where framing members are 24 in. o.c..
   4. For applications on wood or other applications, refer to Gypsum Association GA-216 for fastener type and spacing.

B. On partitions except shaft wall:
   1. Use maximum length sheets practical to minimize end joints.
   2. When gypsum board is installed parallel to framing members, space fasteners 12 inches on center in field of the board, and 8 inches on center along edges.
   3. For applications on wood or other applications, refer to Gypsum Association GA-216 for fastener type and spacing.
   4. When gypsum board is installed perpendicular to framing members, space fasteners 12 inches on center in field and along edges.
   5. Stagger screws on abutting edges or ends.
   6. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
   7. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
   8. On Z-furring members apply gypsum board vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

C. Wall Tile Base: Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install gypsum backing board. At "wet" areas, install with un-cut long edge at bottom of work, and space 1/4" above fixture lips. Seal ends, cut-edges and penetrations of each piece with water resistant compound before installation.

3.06 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install metal corner beads at external corners of drywall work. Corner beads are to be completely bedded and taped.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

D. Install metal control joints where indicated on drawings. If not indicated on drawings, install in accordance with the following:
   1. Interior Partitions: Maximum Single Dimension not to exceed 20 feet. Maximum Single Area not to exceed 400 SF.
   2. Interior Ceiling With Perimeter Relief: Maximum Single Dimension not to exceed 40 feet. Maximum Single Area not to exceed 1,600 SF. Install control joint at any change of direction of ceiling framing or support system.

3.07 JOINT TREATMENT

A. General: Joint treatment for gypsum board surfaces is also described in Section 09 91 00 and may be performed under either the gypsum board or painting subcontract.

B. All joints in gypsum board construction are to be taped and floated. This includes work above ceilings, at concealed places and anywhere else joints in gypsum board construction occur.

C. Base for Ceramic Tile: Treat joints and fasteners to comply with directions of water resistant joint compound manufacturer. In areas to be tiled treat fastener heads with water resistant joint compound. Fill tapered edges in gypsum panels with water resistant joint compound, embed joint tape firmly and wipe off excess compound; follow immediately with a second coat of water resistant joint compound over taping coat, being careful not to crown the joint. Fold and embed tape in all interior angles to form true angle.

3.08 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all finished areas open to public view.

B. Before proceeding with installation of finishing materials, assure the following:
   1. Gypsum board is fastened and held close to framing or furring.
   2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the construction.

3.09 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including non-decorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction, where applicable.

3.10 INSTALLATION

A. ASTM C840-08 or GA-216-2024 provides the following requirements for installing control joints in gypsum board assemblies:
   1. Section 20.2 (GA 4.7.1.1 & GA 4.7.2) – Control joints shall be installed where indicated on the plans. Full height door frames shall be considered equivalent to a control joint.
   2. Section 20.3 (GA 4.7.3) – Control joints in the gypsum board shall be specified by the architect or designer where any of the conditions described in 20.3.1-20.3.5 exist (GA 4.7.3.1 – 4.7.3.7).
   3. Section 20.3.1 (GA 4.7.3.1) – A control joint shall be installed where a partition, wall, or ceiling traverses a construction joint (expansion, seismic or building control element) in the base building structure.
   4. Section 20.3.2 (GA 4.7.3.2) – Control joints shall be installed where a wall or partition runs in an uninterrupted straight plane exceeding 30 linear feet.
   5. Section 20.3.3 (GA 4.7.3.3) – Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 ft and total area between control joints does not exceed 2500 sq ft.
   6. Section 20.3.4 (GA 4.7.3.4) – Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 ft and total area between control joints does not exceed 900 sq ft.
   7. Section 20.3.5 (GA 4.7.3.5) – Control joints in exterior ceilings and soffits shall be installed so that linear dimensions between control joints do not exceed 30 ft and total area between control joints does not exceed 900 sq ft.
   8. Section 20.3.6 (GA 4.7.3.6) – A control joint or intermediate blocking shall be installed where ceiling framing members change direction.
   9. Section 20.3.7 (GA 4.7.3.7) – Control joints shall be installed where specified by the architect or designer as a design accent or architectural feature.

10. Section 20.4 (GA 4.7.4) – Where a control joint occurs in an acoustical or fire-rated system, blocking shall be provided behind the control joint by using a backing material such as 5/8 in. type X gypsum board, mineral fiber, or other tested equivalent.

3.11 CLEANING UP

A. Do not allow accumulation of scraps and debris arising from work of this Section. Maintain premises in neat and orderly condition at all times. Immediately remove spilled or splashed compound material and all trace of residue from adjoining surfaces.

END OF SECTION 09 21 16

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.
   3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:
   1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 REFERENCED DOCUMENTS

A. ASTM Standards:
   1. A 641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
   2. A 653 - Specification for Sheet Steel Zinc coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
   3. B 69 - Specification for Roller Zinc.
   4. C 79 - Test Method for Gypsum Sheathing Board.
   5. E 84 - Test Method for Surface Burning Characteristics of Building Materials.
   6. E 119 - Method for Fire Tests of Building Construction and Materials.
   7. A1011 - Standard Specification for Structural Steel.
   8. F1267 - Standard Specification for Metal, Expanded, Steel.

B. Gypsum Association
   1. GA-253 - Application of Gypsum Sheathing

C. Other Code Approvals and Performance Standards
   1. NAAMM EMMA 557-20 Standards for Expanded Metal.
   2. UL File Number R19331 Full list of ProSTUD, Spazzer, Resilient Channel, Sound Clip and Barrier Mesh UL design assemblies.

3. UL 2079-Fifth Edition. Provides joint protection for up to 1" with UL 2079 Class II or III Movement Capabilities at 80% compression. Use BlazeFrame® Perimeter L-Bead where Composite Firestop/Framing for use in fire-resistant joint systems in or between fire-resistance-rated walls and floor/ceiling or roof/ceiling assemblies (Fire, Smoke and Sound).

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

1.05 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with product-certification program of the Certified Steel Stud Association.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.

B. Protect coatings (pail products) from freezing and temperatures in excess of 90 deg. F. Store away from direct sunlight.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTSS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.02 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM A1003 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A653/A653M, G40 (Z120), hot-dip galvanized unless otherwise indicated. Galvannealed products are unacceptable.

C. Studs and Tracks: ASTM C645. Use either conventional-thickness steel studs and tracks, engineered high-strength drywall steel studs and tracks.
1. Steel Studs and Tracks:
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; or a comparable product by one of the following:
      1) CEMCO; California Expanded Metal Products Co.
      2) Telling Industries.
      3) Approved equal.
   b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection 0.0147 inch.
   c. Depth: As indicated on Drawings.
2. Engineered High-Strength Steel Equivalent Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C645 steel studs and tracks.
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; ViperStud or a comparable product by one of the following:
      1) CEMCO; California Expanded Metal Products Co.
      2) Phillips Manufacturing Co.
      3) Telling Industries.
      4) Approved equal.
   b. Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements 0.0147 inch.
   c. Depth: As indicated on Drawings.
3. High performing Sound Wall Stud: Factory assembled 3-5/8", 4" or 6" sound isolating double stud using closed cell foam isolators creating sound dampening air gap. Use standard track.
   a. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; SoundGuard Stud by one of the following:
      1) Marino\WARE
      2) SCAFCO
   b. Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements.
   c. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide [one of] the following:
1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement or as required by specific conditions.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; Deflex (WSC) or a comparable product by one of the following:
1) CEMCO; California Expanded Metal Products Co.
2) Steel Network, Inc. (The).
3) Approved equal.

2. Single Long-Leg Track System: ASTM C645 top track with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
a. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; FAS Track, SLT Slotted Track or a comparable product by one of the following:
1) Blazeframe Industries.
2) CEMCO; California Expanded Metal Products Co.
3) ClarkDietrich Building Systems.
4) Metal-Lite.
5) Perfect Wall, Inc.
6) Steel Network, Inc. (The).
7) Telling Industries.

E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; FAS Track or a comparable product by one of the following:
a. Blazeframe Industries.
b. CEMCO; California Expanded Metal Products Co.
c. ClarkDietrich Building Systems.
d. Fire Trak Corp.
e. Metal-Lite.
f. Perfect Wall, Inc.
g. Steel Network, Inc. (The).

F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; Flat Strap or a comparable product by one of the following:
a. CEMCO; California Expanded Metal Products Co.
b. Telling Industries.

2. Minimum Base-Metal Thickness: 0.0296 inch.

G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch wide flanges.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; CRC or a comparable product by one of the following:
      a. CEMCO; California Expanded Metal Products Co.
      b. Telling Industries.
   2. Depth: 1-1/2 inches.
   3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

H. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; Furring Channel or a comparable product by one of the following:
      a. CEMCO; California Expanded Metal Products Co.
      b. Telling Industries.
      c. Approved equal.
   2. Minimum Base-Metal Thickness: 0.0329 inch.
   3. Depth: As indicated on Drawings or 7/8 inch or 1-1/2 inches as required.

I. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; RC1 or RC-Max or a comparable product by one of the following as required:
      a. CEMCO; California Expanded Metal Products Co.
      b. Telling Industries.
      c. Approved equal.
   2. Configuration: Asymmetrical or hat shaped as required.

J. Cold-Rolled Furring Channels: 0.058-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
   1. Depth: 3/4 inch or as required.
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Marino\WARE; Z Furring or a comparable product by one of the following:
      a. CEMCO; California Expanded Metal Products Co.
      b. Telling Industries.
      c. Approved equal.

2.03 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Hanger Attachments to Concrete:
   1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 or ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
      a. Uses: Securing hangers to structure.
      b. Type: torque-controlled, adhesive anchor or as required.
      c. MateriaT for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.
      d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless steel bolts, ASTM F593 (ASTM F738M), and nuts, ASTM F594 (ASTM F836M).
   2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated or as required.

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538-inch and minimum 1/2-inch-wide flanges.
   1. Depth: As indicated on Drawings or 2-1/2 inches or 2 inches or 1-1/2 inches.

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
   2. Steel Studs and Tracks: ASTM C645.
      a. Minimum Base-Metal Thickness: 0.0329 inch or as required.
      b. Depth: As indicated on Drawings.
   3. Engineered High-Strength Equivalent Gauge Steel Studs and Tracks: ASTM C645.
      a. Minimum Base-Metal Thickness: 0.0147 inch or 0.0181 inch as required.
      b. Depth: As indicated on Drawings.
   4. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
      a. Minimum Base-Metal Thickness: 0.0329 inch or as required.
   5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical or hat shaped.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong World Industries, Inc.
   b. Chicago Metallic Corporation.
   c. USG Corporation.

2.04 AUXILLARY SYSTEMS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), non-perforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
   2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
   3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
   4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components in accordance with spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
   2. Multilayer Application: [As required by horizontal deflection performance requirements 16 inches (406 mm) o.c. or 24 inches (610 mm) o.c.unless otherwise indicated.
   3. Tile Backing Panels: As required by horizontal deflection performance requirements 16 inches (406 mm) o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
   c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:
1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:
1. Erect insulation, specified in Section 07 21 00-Thermal Insulation, vertically and hold in place with Z-shaped furring members spaced 24 inches dimension o.c. or as required.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.04 INSTALLING CEILING SUSPENSIONS

A. Install suspension system components in accordance with spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c. or as required.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches or 24 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install tile specified on floors and walls shown.

B. Ceramic floor tile installed over concrete floor slabs using latex Portland cement mortar and latex Portland cement grout.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

B. Sealing of Joints: Section 07 92 00 - Joint Sealants.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. ANSI A108 Installation Standards / A118 Material Specifications - American National Standard Specifications for the Installation of Ceramic Tile.
   1. ANSI A108.02 - Per Section 4.2.2 Substrate flatness for tiles 15 in. (0.38m) or longer: “For tiles with at least one edge 15 in. (0.38 m) or longer, the substrate shall have a maximum permissible variation of 1/8 in. in 10 ft. (3 mm in 3 m) from the required plane, and no more than 1/16 in. variation in 24 in. (2 mmm in 610 mm) when measured from the high points in the surface.”

B. ANSI A136.1 American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile.

C. ANSI A137.1 American National Standard Specifications for Ceramic Tile – 2019, and A137.2 American National Standard Specification for Glass Tile – 2019

D. ANSI A118.3 – Chemical Resistant, Water-Cleanable Tile Setting and Grouting Epoxy and Water-Cleanable Tile Setting Epoxy Adhesive.

E. ANSI A118.4, Modified Dry-Set Cement Mortar.

F. ANSI A118.6, Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.

G. ANSI 118.7, American National Standard Specifications for High-performance Cement Grouts for Tile Installation.

H. ANSI A118.12, American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.

I. ANSI A118.13, American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-set Ceramic Tile Installation.

J. ANSI A118.15, American National Standard Specifications for Improved Modified Dry-Set Cement Mortar-2019.

K. ANSI A326.3 American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials – 2017

L. TCNA (HB) - Handbook for Ceramic, Glass and Stone Tile Installation; Tile Council of North America.

M. ISO 13007 - International Standards Organization; classification for Grout and Adhesives.

1.05 QUALITY ASSURANCE

A. Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

C. Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
   1. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years' experience.

D. Before installing tile, erect mock-ups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mock-ups on site in location and size as directed by Architect.
   2. Demonstrate the proposed range of aesthetic effects and workmanship.
   3. Obtain architect's acceptance of mock-ups before start of final unit of Work.

4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work. When directed, demolish and remove mock-ups from Project site.

E. Install ceramic tile in accordance with recommendations contained in "Handbook for Ceramic Tile Installation" of the Tile Council of North America, Inc., latest edition.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at 50°F (10°C) or more in tiled areas during installation and for 7 days after completion unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.08 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed but a minimum of 12 pieces, for each type, composition, color, pattern, and size.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Tile:
      a. Acme Tile and More
      b. tilebar, (888) 541-3840 **(Basis-of-Design)**
      c. DalTile Corporation
      d. Florida Tile
      e. Approved Equal.
   2. Mortars and Grouts:
      a. American Olean Tile Company, Inc.
      b. Ardex Engineered Cements
      c. Bostik, Inc.
      d. C-Cure Chemical Co.
      e. Custom Building Products
      f. Laticrete International, Inc. **(Basis-of-Design)**
      g. Litokol® S.p.A Epoxy Grout
      h. Mapei Corporation

2.02 PRODUCTS, GENERAL

A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile - 2012" for types, compositions, and grades of tile indicated. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

C. Conform to ADA recommendations for slip resistance by providing minimum coefficient of sliding friction value of 0.42 DCOF AcuTest® for horizontal surfaces expected to be walked upon when wet.

D Large Floor Tile Mortar: Provide Polymer-Enriched Thin-Set or Medium-Bed Mortar for a regular-setting, polymer-enriched (“modified”) mortar ideal for installing large- format tile on floors, and designed to bond and support large tile over a diverse range of floor substrates, interior and exterior. Can also be used to install small-format tile.

E. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

2.03 TILE PRODUCTS

A. Refer to Room Finish Schedule(s) and Product Schedule(s), and details on the drawings for types, colors, textures, patterns, size of Field Tile and Trim Shapes, and Color of Grout Specified, where applicable.

2.04 SETTING MATERIALS

A. Thin-Set Applications at All Non-Wet Area Floors (TCNA F115): Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the manufacturer's standard dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.

B. Thin-Set Applications at All Wet Area Floors and Upper Level Toilet Room Floors (TCNA F122): Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the manufacturer's standard dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.
   1. Waterproofing: Laticrete 9235.
   2. Ardex Engineered Cements, 8+9

C. Thin-Set Applications at All Wet Area Walls (TCNA W244): Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the manufacturer's standard dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.
   1. Waterproofing: Laticrete 9235.
   2. Ardex Engineered Cements, 8+9

D. Thin-Set Applications at All Non-Wet Area Walls (TCNA W243): Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the manufacturer's standard dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.

2.05 GROUTING MATERIALS

A. Provide products to suit specific project requirements in accordance with TCA Handbook and ANSI A118.3 as follows.
   1. Ardex Engineered Cements, WA
   2. Custom Building Products
   3. Laticrete SpectraLOCK® PRO @ wet areas (pools and fountains)
   4 Laticrete PERMACOLOR® for floors and walls
   5. Mapei Corporation

B. Minimum Grout Joint Size: The minimum allowable grout joint size will vary depending on the tile in use and how much one tile differs from another in size.

1. The actual grout size shall be at least three times the actual variation of facial dimensions of the tile supplied.
2. Recommended: 3/16" grout joint at natural tile units and 1/8" at rectified tiles.
3. Recommended at unglazed quarry tile: 3/8" chemical resistant epoxy (Kitchens).

C. Offset Joint Patterns: Running bond/brick joint and any offset patterns utilizing tile where the side being offset is greater than 15", the offset pattern will be a maximum of 33% unless otherwise specified by the tile manufacturer.
1. If an offset greater than 33% is specified, design professional and owner must approve mock-up and lippage.

D. Grout: Where indicated on the drawings, and elsewhere as required for filling the joints between tiles.
1. Polymer-Modified Portland Cement Grout:
a. Custom Building Products Polyblend Sanded Tile Grout; ANSI A118.6, for joints 1/8 – 1/2 inch (3 –13 mm) or approved equal.
b. Custom Building Products Polyblend Non-Sanded Tile Grout; ANSI A118.6 or joints up to 1/8 inch (3 mm) or approved equal.
c. Custom Building Products Prism® SureColor®Tile Grout, ANSI A118.7 for joints 1/8 – 1/2 inch (3 –13 mm) or approved equal.
2. Dry-Set Grout:
a. Custom Building Products White Dry Tile Grout; ANSI A118.6, for joints up to 1/8 inch (3 mm) or approved equal. Note: Dry Tile Grout when gauged with Thin-Set Mortar Admix diluted with water 1:1 will yield a Latex Portland Cement Grout.
3. Chemical Resistant, Water-Cleanable Tile Setting and Grouting Epoxy; ANSI A118.3:
a. Custom Building Products 100% Solids Epoxy Grout or approved equal. Available in all 48 Polyblend grout colors.
b. Custom Building Products CEG-Lite™ 100% Solids Commercial Epoxy Grout or approved equal.

E. Elastomeric Joint Caulk: ANSI A108.01.3.7 Where indicated on the drawings, and elsewhere as required provide:
1. All joints between floors and walls and at joints between tile and dissimilar materials.
a. Commercial 100% Silicone Caulk – ideal for movement joints in traffic areas

2.06 MISCELLANEOUS MATERIALS

A. Metal Edge Protection: Refer to drawings for size, types and finishes as manufactured by Schluter Systems, LP, 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. Tel: (800) 472-4588. Web: www.schluter.com.
1. Edge-Protection and Transition Profiles for Floors
2. Finishing and edge-protection profiles for walls and countertops.

B. Movement Joints-Vertical and Horizontal: In accordance with TCNA Method EJ171-18, to include but not be limited to the following:
   1. Construction Joint - EJ171A-18
   2. Contraction Joint - EJ171B-18
   3. Expansion Joint - EJ171C-18
   4. Isolation/Expansion Joint - EJ171D-18
   5. Expansion Joint, Cement Mortar, Bonded - EJ171E-18
   6. Generic Movement Joint - EJ171F-18
   7. Perimeter Joint - EJ171G-18
   8. Expansion Joint, Cement Mortar, Cleavage Membrane - EJ171H-18
   9. Perimeter Joint - EJ171I-18
   10. Perimeter Movement Joint - EJ171J-18
   11. Movement Joint in Tile and Backerboard - EJ171K-18
   12. Generic Movement Joint with Backerboard - EJ171L-18

C. Provide other materials, not specifically described but required for complete and proper tile installation, selected by Contractor subject to approval of Architect.

D. Provide epoxy coated system if Relative Humidity is over 80% with cementitious self-leveling underlayment to seal concrete. Install per manufacturer of epoxy moisture barrier as supplied by Laticrete, Mapei or approved equal product.

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.

B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

F. **Movement Accommodation Joints:** Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Provide expansion and control joints at not more than 15 feet OC, at all expansion and control joints in the concrete subfloor and where otherwise recommended by the "Handbook for Ceramic Tile Installation" of the Tile Council of America.
3. Movement joints shall be provided throughout the tile and work will conform to ANSI Specification A108.01-3.7; A108.02 – 4.4.and TCA Details EJ171.
4. Allow for non-linear movement accommodation joints, which would not disrupt the flow of a pattern in a layout. Utilize crack-isolation membranes in accordance with TCNA Handbook method F125.
5. Seal all joints in accordance with requirements of Section 07 92 00.

3.04 WATERPROOFING FOR TILE INSTALLATIONS

A. Install waterproofing in compliance with waterproofing manufacturer's instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight. Verify with local plumbing code and whether 24-hour Flood Testing is required at showers and other pooled components or features.

3.05 INSTALLATION METHODS

A. Conform to TCA Handbook for installation on various substrates shown on drawings, using materials listed in Part 2 of this Specification Section.

B. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.06 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, un-bonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 31 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install suspension systems, ceiling boards, panels and tiles, and accessories required for complete installation of acoustical ceilings specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 APPLICABLE STANDARDS

A. American Society for Testing and Materials:
1. ASTM A641 - Specification for Steel Sheet, Zinc-Coated (galvanized) Carbon Steel Wire
2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip Process
3. ASTM C423 - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
4. ASTM C635 - Standard Specification for Metal Suspension Systems for Acoustic Tile and Lay-in Panel Ceilings
5. ASTM C636 - Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
7. ASTM E119 - Fire Test of Building Construction and Materials
8. ASTM E580 - Practice for Application of Ceiling Suspension Systems for Acoustic Tile and Lay-in Panels in Areas Requiring Seismic Restraint
9. ASTM E1111 - Test Method for Measuring Interzone Attenuation of Ceiling Systems
10. ASTM E1264 - Classification for Acoustic Ceiling Products
11. ASTM E1414 - Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum

12. CISCA (Ceilings & Interior Systems Construction Association) - Ceilings Systems Handbook

1.05 PRODUCT HANDLING

A. Protection: Protect suspended acoustical ceiling materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary and at Contractor's expense.

1.06 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials, totaling 3% of the total installed, matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.01 SUSPENSION SYSTEMS

A. Provide steel capped , Suprafine® XL 9/16" exposed tee grid by Armstrong World Industries, USG Interiors, CertainTeed or Chicago Metallic.

B. Suspension Members: **Heavy** seismic type of sufficient strength and rigidity to carry acoustical ceiling units in true and level plane without exceeding 1/32" deflection in any 2 feet of their spans.

C. Fabrication: Fabricate suspension system components from cold-rolled sheet steel conforming to ASTM A 366. Protect from rust and corrosion with hot dipped galvanized coating.

E. Finish for Exposed Members: Factory applied, white, low-gloss, baked-enamel finish. Suspend main suspension system runners from overhead construction members with not less than 12 gauge galvanized steel wire conforming to Federal Specification QQ-W-461.

F. Comply with installation requirements of ASTM E 580 and International Building Code Section 16 for seismic restraint. Conform to Seismic Design Category D.

2.02 ACOUSTICAL TILE (NON-RATED)

A. Provide tile by Armstrong World Industries, USG Interiors, CertainTeed, Rockfon or equal units approved by Architect. Furnish units with Class 25 flame spread index set forth in Federal Specification SS-S-118b, Class III or Class 1 (0-25) as tested in accordance with ASTM E 84, 12" x 12" x 3/4" thick, beveled edge, non-directional fissured design. Furnish tile with factory applied white paint finish. Approximately 10% of tiles to be access tiles.

2.03 ACOUSTICAL CEILING BOARDS (NON-RATED)

A. **ACT-1:** Provide 24" x 24" x 1", Lyra™ #8361PB, 9/16" Square Tegular, by Armstrong® World Industries or approved equal product by USG Interiors or CertainTeed. Provide NRC 0.95 + AC 190.

B. Furnish units rated non-combustible under the Flame Spread Index of Federal Specification SS-S-118b and having factory applied washable white surface finish.

2.04 OTHER MATERIALS

A. Provide materials, not specifically described but required for complete and proper installation of suspended acoustical ceilings, selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Examine surfaces and conditions affecting proper installation of acoustical materials. Do not proceed until unsatisfactory conditions are corrected.

B. Do not start acoustical ceiling work until glazing is completed and exterior openings are enclosed.

C. All wet work, including concrete and masonry work must be completed and dried out before work is started.

D. Do not install acoustical materials unless uniform temperature in spaces where acoustical tile work is performed is at least 60° F. during and after installation.

E. Install acoustical ceilings, complete, including component parts necessary to suspend systems from structure.

F. Install suspension systems to permit border units of greatest possible size where not full size.

G. Following installation, clean soiled and discolored surfaces. Remove and replace units damaged or improperly installed.

H. For any units that do not have square edges and must be cut for any reason, install edge angle or "T" at same elevation as other supporting members and make a field cut in the same profile as the factory edge or splice in a factory edge. Paint cut edges or splice joints to match giving a visually flawless result.
   1. Refer to RevealCut™ Ceiling Tile-Cutting Workstations for 2' and 4' lengths as supplied by Arrow Fastener Company, (800) 776-2228.

END OF SECTION 09 51 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install resilient base and accessories specified. Clean and protect resilient components after installation.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Samples: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

E. Installation and Maintenance Instructions: Submit manufacturer’s published guide for Resilient Top-Set Wall Base.

F. If required, submit the manufacturer's certification that the wall base has been tested by an independent laboratory and complies with the required fire tests.

1.04 QUALITY ASSURANCE

A. Installation Qualification: Contractors for floor covering installation should be experienced in managing commercial flooring projects and provide professional installers, qualified to install the various flooring materials specified. An installer is "qualified" if trained, or a certified by manufacturer or a certified INSTALL (International Standards & Training Alliance) resilient floor covering installer.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver resilient base and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

C. Protect products from damage when handling and during construction operations.

1.06 PROJECT CONDITIONS

A. Install resilient products after other finishing operations, including painting, have been completed.

B. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

C. Maintain the ambient relative humidity between 40% and 60% during installation.

D. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.07 EXTRA MATERIALS

A. Deliver to the Owner / Facility Manager maintenance stock, from the same manufactured lot as materials installed. Furnish 120 LF (one carton) for each color and type of wall base installed, and packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.01 RESILIENT WALL BASE

A. Manufacturer: Johnsonite, Inc., (800) 899-8916, 16910 Munn Road, Chagrin Falls, Ohio 44023. Web: www.tarkettna.com or approved equal.
   1. Mannington BurkeBase
   2. Roppe

B. Furnish homogeneous 4" high, 1/8" thick, set-on type coved base in color(s) selected by Architect. Pre-molded corner units may be used at installer discretion if conditions warrant, but do not place where routine cleaning operations may cause corners to come loose.

1. Traditional Rubber Wall Base
    a. Manufactured from a proprietary thermoplastic rubber formulation.
    b. Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.
    c. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm2 or greater, Class I.
    d. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class A, Smoke <450.
    e. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1 1/4" diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
    f. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
    g. Phthalate-free.
    h. Contains at least 14% pre-consumer recycled content.
    i. 100% Recyclable.

2.02 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation manufactured and warranted by a reputable manufacturer.

B. Adhesives: as recommended by Johnsonite to meet site conditions.

1. Johnsonite 960™ Cove Base Adhesive or approved equal for cleaned and prepped porous surfaces. DO NOT USE AT OUTSIDE CORNER INSTALLATIONS.
2. Johnsonite 946™ Premium Contact Adhesive or approved equal for cleaned and prepped non-porous surfaces such as stainless steel. PREFERRED PRODUCT.
    a. Use at outside corners to ensure faster set-up, especially at short returns.
3. ULTRASTIK™ All Purpose Tape which is double-sided, scrim-reinforced acrylic adhesive tape for applying base trim, as manufactured by Surface Shields.

2.03 OTHER MATERIALS

A. Provide materials, including adhesives, not specifically described but required for complete and proper installation of resilient flooring only as recommended by manufacturer of material to which it is applied and subject to approval of Architect.

B. Covebase Groover recommendation: Model CB-060 as provided by D-Cut Products, Inc., for fabricating outside corners, (630) 916-9100 www.dcutproducts.com

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion and aesthetics of resilient products.

1. **Where existing base material has been removed at existing porous and non-porous wall surfaces, scrape or remove cured adhesives, contact cement or drywall joint compound so that there is a clean and smooth surface before installing new base material.**

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

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient wall base.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Vacuum clean substrates to be covered by resilient products immediately before installation.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's published instructions for installing resilient base. Refer to Installation Video: https://www.youtube.com/watch?v=QCp2MunOCOY
For any installation questions call Johnsonite Technical Hotline: 800-899-8916.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths if practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed corners: Install preformed Outside Corners where utilized before installing straight pieces.

G. Field-Made or Job Formed Corners (recommendation):
   1. Outside and Inside Corners: Install pre-mitered corners first. Seat the bottom of the wall base snugly to the floor on either side of the corner. Anaerobic adhesive (Super Glue) may be used to adhere the two mitered pieces together. This can eliminate any slight gapping. Butt straight pieces of maximum lengths on either side of the pre-mitered corners. Make sure heights of the corner returns and the straight base match up.
   2. Outside corners: Form by bending without producing discoloration (whitening) at bends. DO NOT WHITTLE.
      a. Fold base in half.
      b. Make one continuous cut with a sharp cove base gouger or groover.
      c. Shave both sides, starting halfway down and avoid cutting into original center cut.
      d. Fold tightly; groove out remaining upper portion. Nip top then affix to wall with Johnsonite 946™ Premium Contact Adhesive.
   3. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install resilient flooring. Clean and protect resilient floor areas after installation.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Shop Drawings:
1. Layout of patterns as shown on the construction documents.
2. Edge strip locations showing types and detail cross sections.

1.04 REFERENCES

A. ASTM Designations:
1. ASTM E 492 - Standard Test Method for Laboratory Measurement of lmpact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine
2. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
3. ASTM E 662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
4. ASTM E 989 - Standard Classification for Determination of Impact Insulation Class (llC)
5. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
6. ASTM F 141 - Standard Terminology Relating to Resilient Floor Coverings
7. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
8. ASTM F 1482 - Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
9. ASTM F 1700 - Standard Specification for Solid Vinyl Floor Tile

10. ASTM F 1861 - Standard Specification for Resilient Wall Base
11. ASTM F 1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
12. ASTM F 2170-19a - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
13. ASTM F 2419 - Standard Practice for Installation of Thick Poured Gypsum Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring
14. ASTM F 2471 - Standard Practice for Installation of Thick Poured Lightweight Cellular Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring
15. ASTM F 2678 - Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring
16. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

1.05 QUALITY ASSURANCE

A. Obtain each type, color, and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Qualifications of Installers: Use only skilled and experienced resilient flooring installers for preparation of substrate and installation of flooring. Supervise helpers and apprentices at all times with thoroughly skilled resilient flooring installers.

C. Manufacturers' Recommendations: Manufacturers' recommended methods of installation and the referenced applicable standards is basis for installation methods used on this work.

D. Applicable Standards:
   1. Federal Specifications:
      (a) SS-T-312B Tile, Floor: Asphalt, Rubber, Vinyl-Composition.
      (b) SS-W-40A Wall Base: Rubber and Vinyl Plastic.
   2. Resilient Tile Institute:
      (a) Recommended Installation Specifications for Vinyl Composition Tile Flooring and Asphalt Tile Flooring.
   3. Rubber Manufacturer's Association:
      (a) Manual for the Preparation of Subfloors for the Installation of Solid Vinyl and Rubber Flooring.
      (b) Specifications for Flexible Vinyl Cove Base.
      (c) Specifications for Rubber Cover Base.
      (d) Specifications for Solid Vinyl Flooring.
   4. Conform to ADA requirements for slip resistance by providing minimum coefficients of sliding friction of 0.6 COF for horizontal surfaces and 0.8 COF for ramps and other sloped surfaces.

E. **Mockup:** Build floor tile mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Size: 100 sq. ft. for each type, color, and pattern. Locations as indicated on construction documents.
   2. Design Professional approved mockup may become part of the completed Project if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver flooring and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).

C. Store flooring materials on flat surfaces. Move flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.07 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).

B. Do not install flooring until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during installation.

1.08 SEQUENCING AND SCHEDULING

A. Install flooring and accessories after other finishing operations, including painting, have been completed.

B. Do not install flooring over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by flooring manufacturer's recommended bond and moisture test.

1.09 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials, totaling 3% of the total installed, matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.01 LUXURY VINYL TILE

A. Refer to the Room Finish Schedule and Product Schedule on the drawings.

B. Wet spread to be backing-specific manufacturer's adhesives for non-porous sub-floor. Provide Limited 10 Year Commercial Warranty against excessive surface wear, static, delamination, edge ravel, zippering and backing resiliency loss.

2.02 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated. Provide materials for filling cracks and leveling floor depressions by Mapei, or approved equal.

C. Adhesives: Water-resistant type recommended by flooring manufacturer to suit resilient flooring products and substrate conditions indicated, if required.
   1. Provide HENRY® 695 premium, high-strength adhesive for the permanent installation of vinyl-backed flooring as both a wet-set and a pressure-sensitive adhesive or approved equal.

D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of flooring, and in maximum available lengths to minimize running joints.

E. Furnish beveled edge strips 1-1/8" wide where resilient flooring adjoins other floor finish of lower level.

F. Provide Schluter®-DILEX-EKSB Series Surface Joint Profile transition strip in floor tile at all saw-cut or screed key joints in concrete, new or existing. Finish shall be stainless steel or color as selected by the design professional.

2.03 OTHER MATERIALS

A. Provide materials, including adhesives abd moisture vapor barrier, not specifically described but required for complete and proper installation of resilient flooring only as recommended by manufacturer of material to which it is applied and subject to approval of Architect.
   1. ARDEX VB 100™ Fast-Track, One-Component Moisture Vapor Barrier or approved equal. Install per manufacturer published recommendations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where installation of flooring will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.
   2. Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.
   4. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
   5. ASTM F710 - Practice for Preparing Concrete Floors. Concrete ph determination.

3.02 PREPARATION

A. Comply with manufacturer's installation specifications to prepare substrates indicated to receive flooring.

B. Use trowelable leveling and patching compounds per manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by flooring immediately before installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.03 TILE FLOORING INSTALLATION

A. Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles in pattern as indicated on the drawings.

D. Where demountable partitions and other items are indicated for installing on top of finished tile floor, install tile before these items are installed.

E. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edging, thresholds, and nosing.

F. Extend tiles into toe spaces, door reveals, closets, and similar openings.

G. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

H. Install 1-1/8" wide bullnose edging strips where edges of tile are exposed.

I. Install tiles on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

J. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

K. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

L. Hand roll tiles where required by tile manufacturer.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by flooring manufacturers.
   2. Sweep or vacuum floor thoroughly.
   3. Do not wash floor until after time period recommended by resilient flooring manufacturer.

4. Damp-mop flooring to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by flooring manufacturer.
   1. Apply protective floor polish to flooring surfaces that are free from soil, visible adhesive, and surface blemishes.
   2. Use commercially available, metal, cross-linked acrylic product acceptable to flooring manufacturer.
   3. Coordinate selection of floor polish with Owner's maintenance service.
   4. Cover flooring with undyed, untreated building paper until inspection for Substantial Completion.
   5. Do not move heavy and sharp objects directly over flooring. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean flooring not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean flooring using method recommended by manufacturer.
   1. Strip protective floor polish that was applied after completing installation prior to cleaning.
   2. Reapply floor polish after cleaning.

END OF SECTION 09 65 19

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PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnish labor, materials, tools and equipment required and install decorative, seamless epoxy quartz flooring, cove base and walls specified.

B. ***** BROADCASTING ALLOWED ONLY AT SHOWER FLOORS AND AREA BEYOND SHOWER ENCLOSURE(S)***UNLESS OTHERWISE NOTED (UON)**

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Subcontractor Qualifications: Use installer approved and licensed representative of manufacturer of materials used. Use mechanics experienced in commercial installation of materials used and factory trained and qualified by manufacturer.

B. Single Source Responsibility: Obtain each color, grade, finish, type, composition, and variety of flooring material from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

C. Field Constructed Mock-up: Before installing flooring, erect mock-ups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mock-ups on site in location and size as directed by Architect.
   2. Demonstrate the proposed range of aesthetic effects and workmanship.
   3. Obtain Architect's acceptance of mock-ups before start of final unit of Work.
   4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work.

5. When directed, demolish and remove mock-ups from Project site.

E. Pre-Installation Conference: Conduct conference at Project site as directed by Architect.

1.05 REFERENCES

A. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.

B. ANSI A326.3 Method For Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Material,

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Maintain temperatures at 50°F (10°C) or more during installation and for 7 days after completion, unless higher temperatures are required by manufacturer's instructions.

C. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.07 WARRANTY

A. System manufacturer and system installer required to jointly warrant against bond failure, cracking, and deteriorations of seamless covering installed on structurally sound substrate for period of one year after acceptance of project and to replace, repair, or make good defective work or materials at Contractor's expense during warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide Seamless Floor Covering by the following manufacturers:
1. TNEMEC Company, Inc., Eagle Rock Coatings, LLC, 501-448-2111.
2. Desco™ Coatings, Inc., 800-426-4164.
3. Terroxy® as supplied by Terrazzo & Marble Supply Companies, 800-762-7253.
4. SIKA Epo-Rok® Industrial Flooring Systems, 800-933-7452.

2.02 MATERIALS

A. Seamless Epoxy Walls: Provide Tnemec Series 223 Deco-Trowel®, Trowel Grade only, minimum 3/16" thickness at walls.
   1. Provide integral cove base where indicated on Finish Schedule.
      a. Provide 1/2" Deep x 1/8" Heavy Top Thickness Zinc "L" Cove Strip with continuous bead of silicone sealant or approved caulk at top.

B. Seamless Epoxy Flooring: Provide Tnemec Series 222 Deco-Tread® Multi-Purpose Epoxy Coating, double broadcast at 1/8" thick minimum. For use at shower floors and other floor areas subject to water and moisture build-up, providing slip-resistance. **BROADCASTING ALLOWED UNDER THESE CONDITIONS, UON**.
      a. Provide 1/2" Deep x 1/8" Heavy Top Thickness Zinc "L" Cove Strip with continuous bead of silicone sealant or approved caulk at top.

C. Minimum Performance Characteristics:
   1. Impact Resistance: Gardner Impact Test. 160 in/lb - no cracking, chipping or delamination.
   2. Indentation Resistance: MIL D 3134F, Section 4.74. Withstands 2,000 lbs/sq. in. for 30 minutes without indentation.
   3. Tabor Abrasion Resistance: CS17 Wheels with 2,000 gm load for 10,000 cycles. 27.6 mg average loss per 1,000 cycles.
   4. Toxicity: U.S. Department of Agriculture Research Service Meat Inspection Division, Non-Toxic.
   5. Flammability: ASTM E-84 Tunnel Test. Flame Spread Classification (FSC) not to exceed 35.
   6. Compressive Strength: ASTM C-579 - 10,400 psi.
   7. Chemical Resistance: Unaffected by the following:

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
Iodine	Betadyne

D. **Slip Resistance Level:** Provide grit or anti-slip additive compatible with the floor coating system. Choices shall be between light, medium and heavy textures, depending on the needs of the specific area, to be approved by the architect.
   1. 60 mesh aluminum oxide – Smaller grit size for a less aggressive texture
   2. 30 mesh aluminum oxide – Larger grit size for a more aggressive texture
   3. Different grades shall allow installers to create various levels of slip-inhibiting surface texture in accordance with facility and operational needs.

2.03 SHOWER APPLICATION

A. Walls, cove and pan floor are to be applied integrally in same thickness throughout.
   1. Provide Desco™ HydraBond Primer and System or equal system where required at slabs.

2. Where top of wall application does not extend to ceiling, provide metal edge termination trim and apply clear silicone sealant to prevent moisture from getting behind wall substrate.
3. Base Coat: Tnemec Series 222 100% Solids Epoxy with Color Quartz.
4. Topcoat: Tnemec Series 285 Satin Glaze. Slip Resitance Level Shall be medium Texture.
5. Substrate at walls (metal/wood stud construction) may be USG Durock® Brand Cement Board with the rough side turned out.

2.04 OTHER MATERIALS

A. Provide materials not specifically described but required for complete and proper installation of seamless flooring of new, first quality of their respective kinds, in strict accordance with recommendations of manufacturer of flooring used, and subject to approval of Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and areas where flooring will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed flooring.
1. Verify that substrates are firm, dry, clean, and free from oil or waxy films and curing compounds.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind flooring has been completed before installing flooring.
3. Notify the Architect of any cracks or irregularities in the substrate that might telegraph through the flooring or cause it to crack.
4. Installer must examine substrates for moisture content and other conditions under which flooring is installed, and notify Contractor in writing of conditions detrimental to proper completion of this work. Do not proceed until unsatisfactory conditions are corrected.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Prepare substrate surfaces including etching of concrete floors, application of sealer or primer coats and preparation required to obtain optimum adhesion to surfaces, to seal surfaces against migration of foreign materials through coating, and to provide for smooth, uniform finished surface.

B. Patch all depressions, divots, honeycombed or scaled concrete with filler as recommended by manufacturer.

C. Fill all non-moving cracks or control joints with joint filler as recommended by manufacturer.

D. Fill all moving cracks or joints with a firm but flexible sealant material as recommended by manufacturer. Control joints should be re-cut in finished floor if required and filled with sealants.

E. Mask surfaces that require protection.

3.03 INSTALLATION

A. Apply flooring in accordance with manufacturer's printed instructions, employing lead mechanic qualified under the quality assurance portion of this specification, using equipment specifically designed for this purpose.

B. Surfacing shall be tightly compacted, trowel applied. Trowel apply vertical cove base and hand sand cove base. Apply three coats of resin to assure a smooth surface and cove. Do not allow resin to puddle in cove.

C. Finished work shall match approved samples; be uniform in thickness, sheen, color, pattern, and texture; and be free from defects detrimental to performance.

D. CMU substrate shall be clean and dry so installer can prime and prepare before troweled-on product is applied. Painter is NOT to apply any block filler at areas designated to receive TNEMEC product.

3.04 PROTECTION

A. During work under this Section protect surfaces of other trades against damage. After installation allow no traffic on seamless covering for at least 72 hours. Protect completed flooring from damage until final acceptance of project by Owner.

END OF SECTION 09 67 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. General: Furnish and install vinyl wall covering specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers:
   1. For cutting and installation of vinyl wall covering, use only thoroughly trained and experienced installers completely familiar with manufacturer's installation recommendations and completely familiar with requirements of this work.
   2. In acceptance or rejection of installed wall covering, no allowance made for lack of skill on part of installers.

B. Manufacturer's Recommendations: Wall covering manufacturer's recommendations is basis for installation methods used in this work.

1.05 PROJECT CONDITIONS

A. Maintain a constant temperature not less than 60° F (16° C) in installation areas for at least 10 days before and 10 days after installation.

B. Lighting: Do not install wall covering until a permanent level of lighting is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall covering manufacturer for full drying or curing.

1.06 PRODUCT HANDLING

A. Protection: Protect vinyl wall covering materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wall-Covering Materials: For each type, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.01 VINYL WALL COVERING

A. Furnish all vinyl wall covering product of same manufacturer and of color and texture to be selected by Architect from manufacturer's standard line. Furnish "Embossed" material classed as Decorative Only Category II, 24 oz., 54" wide, Class "A" fire-rated, in accordance with Federal Specification CCC-W-408. Furnish wall covering material that meets or exceeds ASTM E 84 tunnel test.

2.02 ADHESIVES

A. Manufacturer's standard for use with specific wall covering and substrate application.

B. Characteristics: Mildew-resistant, non-staining, and strippable.

C. No wheat paste adhesives will be allowed.

D. DO NOT DILUTE ADHESIVE WITH WATER.

2.03 BRIDGING MATERIAL

A. Provide polyester fabric bridging material at areas where required to provide a smooth substrate for application of wall covering. Apply with manufacturer's recommended adhesive.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:
   1. Carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.
   2. Verify wall covering may be installed in accordance with manufacturer's recommendations.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 PREPARATION

A. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

B. Follow manufacturer's printed instructions for surface preparation.
   1. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
   2. Painted Surfaces: Treat areas susceptible to pigment bleeding.
   3. Metals: If not factory-primed, clean and apply rust inhibitive zinc primer.
   4. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
   5. Prime new gypsum board with a recommended primer.
   6. Wall Sizing: Size surfaces to receive wall covering with material recommended by wall covering manufacturer.

C. Check painted surfaces for pigment bleeding. Sand gloss, semi-gloss, and eggshell finishes with fine sandpaper.

D. Install wall liner, with no gaps or overlaps, where required by wall covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall covering installation until wall liner has dried.

3.03 INSTALLATION

A. Follow manufacturer's printed instructions for installation.

B. Install wall covering with no gaps or overlaps.

C. Install seams vertical and plumb at least 6 inches from outside corners and 3 inches from inside corners. No horizontal seams.

D. Remove air bubbles, wrinkles, blisters, and other defects.

E. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

3.04 CLEANING

A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended by the wall covering manufacturer. Do not use carbon-tetrachloride, cleaning solvents, or cleaning agent not specifically recommended by wall covering manufacturer.

C. Replace strips that cannot be cleaned.

END OF SECTION 09 72 00

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide specified painting and finishing of interior and exterior items.
   1. Provide painting of all new exposed steel and iron work, including primed metal surfaces. Paint exposed-to-view pre-finished metal surfaces of items, if required. Refer to drawings for existing metal to be painted.
   2. Provide touch-up of pre-finished items to match original finish.
   3. **Do not paint** waterproof coatings, water repellent coating, acoustical ceilings, toilet partitions, aluminum with factory applied finish, or pre-finished items, except as noted above.
   4. **Do not paint** over any code required metal labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates. Mask off the label before applying finish and remove masking after finish is dry.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 DEFINITIONS

A. Term "paint", as used herein, includes enamels, paints, sealers, fillers, emulsions, varnishes, stains, and other coatings whether used as prime, intermediate, or finish coats.

1.05 QUALITY ASSURANCE

A. Qualifications of Painters: Use only qualified journeyman painters for mixing and application of paint. In acceptance or rejection of painting, no allowance made for lack of skill on part of painters.

B. Mockups - Interior: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 SF.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
      3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
      4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 PRODUCT HANDLING

A. Delivery: Deliver paint materials to job site in original unopened containers with labels intact and legible at time of use.

B. Protection:
   1. Store only approved materials at job site and store only in suitable and designated area restricted to storage of paint materials and related equipment.
   2. Ensure safe storage and use of paint materials and prompt and safe disposal of waste.
   3. Protect paint materials before, during, and after application and protect installed work and materials of other trades.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Manufacturers: Provide paints, enamels, stains, varnishes, and admixtures of first line quality by Sherwin Williams or approved equal. Sherwin Williams products specified herein establish minimum quality standards. Approved equal products:
   1. Farrell-Calhoun
   2. PPG Paints
   3. Benjamin Moore

B. Compatibility:
   1. Paint materials and equipment to be compatible. Finish coats compatible with prime coats, prime coats compatible with surface to be coated, and tools and equipment compatible with coating applied.
   2. Thinners (when used): Use thinners recommended for that purpose by manufacturer of material thinned.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify work is complete to point where painting work may properly commence. Verify paint finishes may be applied in strict accordance with manufacturer's directions and requirements of these Specifications.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 PREPARATION OF SURFACES

A. Protection: Completely mask, remove, and adequately protect hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces not scheduled to receive paint.

B. Priming: Use primer recommended by manufacturer of coating system. Spot prime exposed nails and metals to be painted with emulsion paints.

C. Cleaning: Thoroughly clean surfaces receiving paint. Schedule cleaning and painting so dust and contaminants from cleaning process will not fall on wet, newly painted surfaces.

D. Gypsum Board: Treat and conceal joints, screw heads, and depressions in gypsum board surface in accordance with manufacturer's recommendations and instructions. Painted surfaces must be completely clean and continuously smooth. Treat internal and exterior corners and angles formed by intersection of wallboard surfaces and wallboard edges with joint reinforcements system in accordance with manufacturer's standard installation specifications where intersections and edges do not have metal trim. **All joints in gypsum board construction are to be taped and floated. This includes work above ceilings, at concealed places and anywhere else joints in gypsum board construction occur.** A slight egg-shell texture may be acceptable if approved by Architect prior to application. **Heavy "knockdown" texturing is not acceptable.**

E. Concrete and Concrete Block: Prepare surfaces in strict accordance with paint manufacturer's instructions and recommendations. Remove chalk, dust, dirt, grease, oils and substances which negatively effect paint adhesion. Perform appropriate tests to determine alkalinity and moisture content of surfaces. If surfaces are found sufficiently alkaline to cause blistering and burning of paint, correct condition before applying paint.

F. Primed Ferrous Metals: Clean ferrous metals free of dust, grease and grime. Sand smooth rust spots, mars and abrasions in surfaces. Touch-up shop-applied prime coats which have damage or bare areas. Wire-brush, solvent clean, and touch up with same primer as shop coat.

G. Non-ferrous Metals: Clean off all oxidation, dust, grease and grime.

H. Galvanized Metal Surfaces: Clean free of oil and surface contaminates with acceptable non-petroleum based solvent. Touch up bare metal with zinc chromate primer.

3.03 WORKMANSHIP

A. Do not perform outside painting in extremely cold, frosty, or damp weather. Do not paint in dusty rooms. If required, sprinkle floors, to lay dust. Do not apply coats of paint on either wet or damp surfaces and in no case unless preceding coat is dry and hard.

B. Clean surfaces before priming. Remove dirt, oil, grease, rust, scale, and foreign matter. Clean with sandpaper, steel scraper, or wire brushes where necessary.

C. Specified coats are to cover completed painting and finishing work. Where color, stain, or undercoats show through final coat, install additional coats until uniform coverage is obtained.

D. Vary tints of undercoats slightly for identification of succeeding coats. Ample time of drying required to secure best possible results.

E. Coats specified are in addition to shop or mill priming required under other Sections of these specifications.

F. All cabinet devices that require finish painting are to be painted with doors in the open position and shall be allowed to dry for a minimum of 24 hours in the open position. DO NOT PAINT DOORS CLOSED AND TRIM AFTER DRYING.

1. Cabinets that require finish painting include, but are not limited to, wall and ceiling access doors, fire extinguisher/hose/valve cabinets, electrical panel boxes, etc.

G. Corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures, and fire walls shall be effectively and permanently identified with signs or stenciling in a manner acceptable to the authority having jurisdiction. Label each wall at 20'-0" maximum. Such identification shall be above any decorative ceiling and in concealed spaces. Approved wording is to be:

FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS

3.04 MOISTURE CONTROL

A. Give back side of interior wood trim in contact with masonry units one application of water repellent preservative.

3.05 PAINT SCHEDULE

A. Finish surfaces as follows:

	SURFACE	TREATMENT
1.	**Exterior Steel / Ferrous Metals:**	1st Coat - SW Pro-Cryl® Universal Acrylic Primer B66W00310 Series (Touch up only on primed surfaces) 2nd & 3rd Coats - SW B66W01151 - Pro Industrial DTM Acrylic Semi-Gloss
1b.	**Exterior Steel/Metal Roof /Wall Panels/Trim/Gutters/Downspouts:**	For Satin Finish 1st and 2nd coats of - SW Bond-Plex® Waterbased Acrylic For Semi Gloss or Gloss Finish 1st Coat - SW Bond-Plex® Waterbased Acrylic; 2nd Coat - SW ProIndustrial SherCryl Semi Gloss or Gloss Finish
2.	**Interior Ferrous Metals:**	1st Coat - SW Pro-Cryl Universal Water Based Primer, B66-310 Series (Touch up only on primed surfaces) 2nd & 3rd Coats - SW ProMar 200 Alkyd Eg-Shel B33 or S/G B34 as selected by Architect.
3.	**Interior Aluminum:**	1st Coat - SW Pro-Cryl Universal Water Based Primer, B66-310 Series (Touch up only on primed surfaces) 2nd & 3rd Coats - SW ProMar 200 Alkyd Eg-Shel B33 or S/G B34 as selected by Architect.
4.	**Exterior Aluminum:**	Primer - SW B66W00310 - Pro Industrial Pro-Cryl® Universal Acrylic Primer. 2 Coats - SW B66W00351 - Sher-Cryl HPA High Performance Acrylic Semi-Gloss Coating.
5.	**Galvanized Metals:**	1st Coat: SW B66W00310 - Pro Industrial™ Pro-Cryl® Universal Acrylic Primer, Off White 2nd & 3rd Coats: SW B66W01151 Pro Industrial DTM Acrylic Semi-Gloss Extra White.
6.	**Int. Gyp. Board - Painted:**	1st Coat - SW PrepRite High Build Latex Wall Primer/Surfacer, B28W601 2nd & 3rd Coats - SW ProMar 200 Latex Eg-Shel B20-2200 or S/G B31-2200 Enamel as selected by Architect.
7.	**Int. Gyp. Board - Glazecoat:**	SW Water Based Epoxy Resin, B70-200 Series with Gloss Hardener B60V15

8. **Interior CMU - Painted:** Prime Coats - SW PrepRite Block Filler, B25W25 as required to eliminate all pinholes.
2nd & 3rd Coats - SW ProMar 200 Latex Eg-Shel B20-2200 or S/G B31-2200 Enamel as selected by Architect.

9. **Interior CMU - Glazecoat:** Fill CMU walls with Three (3) Coats of Sherwin Williams Heavy Duty Block Filler, B42W46.
Apply another coat if more than 10 pinholes within 2' x 2' area.

SW Water Based Epoxy, B70-200 Series with Gloss Hardener B60V15

3.06 PAINTING OF MECHANICAL AND ELECTRICAL WORK

A. Painting of pipe and duct insulation and un-coated ferrous metal in inaccessible pipe and duct chases, in plumbing chases, and in spaces above ceiling is not required.

B. Metal Work in Mechanical Room (finish as follows):
   1. Clean pre-finished equipment and touch up with enamel to match manufacturer's final coat.
   2. Clean exposed pipe, exposed conduit and electric outlet boxes, hangers and brackets, valve handles, and miscellaneous pipe line devices and give two coats of medium gray enamel.
   3. Clean prime painted or unfinished items of manufactured mechanical and electrical equipment, then prime and finish with two coats of enamel to match other finished items of equipment.
   4. Finish remaining exposed metal items with two coats of light grey enamel.

C. Paint exposed interior metal work, including ferrous and non-ferrous piping, for heating ventilating, plumbing and electrical equipment, electric cabinets, ventilating grilles, metal access panels. Give exposed metal items one coat of enamel undercoater and one coat of enamel in addition to priming coat.

D. Give pipe and duct insulation exposed to view one coat glue size and two coats enamel.

E. Paint all mechanical, electrical and plumbing items that are visible through registers, grilles and diffusers with Flat Black-Out paint.

3.07 PROTECTION, CLEAN UP, AND TOUCH-UP

A. Protect all work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint drops and smears from hardware, glass and other surfaces and items.

C. Before final inspection, touch-up or refinish painted surfaces which have become damaged or discolored.
   1. Perform touch-up work in a manner to produce solid even color and finish texture to match surrounding color and finish texture.
   2. Areas that receive touch-up work and do not match surrounding color or finish texture will be refinished at Contractors expense.

3.08 REPAINTING AND REFINISHING

A. Thoroughly clean existing surfaces in present building to be repainted and give one or more new coats of same type of paint originally used. Clean existing natural finish surfaces, sand and give new coat of varnish or finish originally used. Treat patched and repaired surfaces as new surfaces. For bidding purposes figure two coats of paint as average requirement. Scrape surfaces to be repainted, sand by hand or machine, and prepare to receive new coats.

B. Paint rooms and areas in existing building noted on drawings to paint existing surfaces or required by Finish Schedule.

C. Paint all rooms and areas in existing building where cutting and patching occurs. Paint after cutting, patching, and remodeling in rooms and areas is completed. Where cutting and patching is required on only one wall or surface, paint the entire room or area. Where cutting or patching occurs along a corridor wall, paint entire corridor wall from corner to corner or between termination lines designated by Architect.

END OF SECTION 09 91 00

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PART 1 - GENERAL

1.01 SUMMARY

A. General: Provide all labor, materials, equipment, tools and services, necessary to complete the fabrication and installation of the Work, as indicated by the Drawings.

B. Coordination: Assign a Project Manager prior to beginning Work for coordination with the Owner for complete understanding and execution of the project requirements throughout the entire project. This includes, but is not limited to project meetings, submission review, fabrication and installation.

C. Provide 911 address signage on outside of building as required by local municipality and NFPA:
   1. NFPA 1 Fire Code 2018: New and existing buildings shall have approved address numbers placed in a position to be plainly legible and visible from the street or road fronting the property. Address numbers shall be a minimum of 4 inches (100 mm) high with a minimum stroke width of 1/2 inches (13 mm).

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Shop Drawings: List sign styles, lettering, materials, thicknesses, locations and dimensions of each interior sign.

D. Selection Samples: One complete set of color chips representing manufacturer's full range of available colors.

E. Verification Samples: Two full size samples representing each type, style, material, thickness, and color specified, including method of attachment.

1.04 QUALITY ASSURANCE

A. Use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, and thoroughly familiar with requirements of this work.

B. Regulatory Requirements: Comply with requirements of ICC/ANSI A117.1 and ADAAG.

1.05 PRODUCT HANDLING

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results.

PART 2 - PRODUCTS

2.01 BUILDING SIGNAGE

A. Contractor to allow the sum as stipulated in Section 01 21 00 - Allowances, in the Base Bid for purchase, taxes, delivery to site and installation of all exterior and interior building signage to be selected by Architect. Allow minimum 6-8 weeks for production and installation of typical identification signage prior to local Certificate of Occupancy.

B. All signage to be purchased under the stated allowance will comply with the 2017 ICC ANSI A117.1 Accessible and Usable Buildings and Facilities ADA Standards for size, location, color, type face and braille.

C. Allowance shall include building address numbers as may be required by local municipality. Minimum 4" high premium vinyl decals on pre-spaced sheet in color and font as selected by architect, or as otherwise indicated on the drawings. Coordinate location with local Authority Having Jurisdiction.

2.02 FEDERAL ACCESSIBLE RESERVED PARKING SIGNAGE (ACCESS SIGNS)

A. Supplier: ADA Sign Depot, Inc., 10531 4S Commons Drive #622, San Diego, CA 92127, Tel.: (858) 385-9095 or approved equal.

B. Provide 12" wide x 18" high Federal R7-8 Handicap Parking sign as indicated on the drawings.
   1. Meets all Federal MUTCD (Manual of Uniform Traffic Control Devices) Specification for Design, Materials and Manufacturing
   2. Engineer Grade Prismatic Reflective sign face.
   3. Heavy-gauge .063 aluminum.
   4. Durable, Rust-Free, and Rated for a Minimum of 7 Years Outdoor No Fade Service.
   5. Parking sign is pre-drilled with standard .375-inch diameter holes at top and bottom center for easy mounting to posts or walls.

C. Provide 12" wide x 18" high Federal R7-8-MOD Van Accessible Handicap Parking sign as indicated on the drawings and matching criteria for R7-8 sign.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install signage in accordance with manufacturer's recommendations.

END OF SECTION 10 14 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install toilet partitions, urinal screens specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Use personnel skilled in work required, completely familiar with manufacturer's recommended methods of installation, and thoroughly familiar with requirements of this work.

1.05 PRODUCT HANDLING

A. Protection: Protect toilet partitions and other items under this Section before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

PART 2 - PRODUCTS

2.01 SOLID PLASTIC TOILET AND URINAL PARTITIONS

A. Provide floor mounted, overhead braced units as manufactured by one of the following:
1. Hadrian, Inc., 7420 Clover Ave., Mentor, Ohio, 44060; Tel.: (800) 536-1469.

2. Bradley Corporation, Menomonee Falls, WI 53051; Tel.: (800) 272-3539.
3. Metpar Toilet Partitions, 95 State St., Westbury, NY 11590; Tel.: (516) 333-2600.
4. ASI Global Partitions, 900 Clary Connector, Eastanollee, GA, 30538; Tel.: (706) 827-2700.
5. Approved Equal manufacturer.

B. Urinal screens, if required, are to be floor anchored with stainless steel shoes and secured to supporting wall with aluminum brackets.

C. Doors, panels and pilasters shall be 1" thick constructed from High Density Polyethylene (HDPE) resins. Partitions shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking. Refer to Product Schedule on drawings for texture / color.

D. CONSTRUCTION
1. Doors, panels, and pilasters shall be 1" thick with all edges rounded to a radius.
2. Doors and dividing panels shall be 55" high and mounted at 14" above the finished floor. An aluminum heat sinc is to be fastened to the bottom edges.
3. Pilasters shall be 82" high (standard) and fastened into a 3" high pilaster shoe with a stainless steel tamper resistant torx head sex bolt.

E. HARDWARE
1. Hinges: Stealth integral hinge from door and pilaster material with exposed metal parts on interior of stall.
2. Door strike/keeper shall be 6" long and made of heavy-duty extruded aluminum (6436-T5 alloy) with a bright dip anodized finish and secured to the pilasters with stainless steel tamper resistant torx head sex bolts. Bumper shall be made of extruded black vinyl.
3. Latch and housing shall be made of heavy-duty extruded aluminum (6463-T5 alloy). The latch housing shall have a bright dip anodized finish, and the slide bolt and button shall have a black anodized finish.
4. Each door shall be supplied with one coat hook/bumper and door pull made of chrome plated zamak. Handicapped doors shall be supplied with a second door pull and out swing doors with one door stop made of chrome plated zamak.
5. Pilaster shoes shall be 3" high (type 304, 20 gauge) stainless steel. Pilaster shoes shall be secured to the pilaster with a stainless steel tamper resistant torx head sex bolt.
6. Wall brackets shall be 1½" stirrup type made of heavy-duty aluminum (6463-T5 alloy) with a bright dip anodized finish. Stirrup brackets shall be fastened to pilasters and panels with stainless steel tamper resistant torx head sex bolts.
7. Headrail shall be made of heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design and integrated curtain track. The headrail shall have a clear anodized finish and shall be fastened to the headrail bracket by a stainless steel tamper resistant torx head sex bolt, and fastened at the top of the pilaster with stainless steel tamper resistant torx head screws.

8. Headrail brackets shall be 20 gauge stainless steel with a satin finish and secured to the wall with a stainless steel tamper resistant torx head screws.

2.02 OTHER MATERIALS

A. Provide materials, not specifically described but required for complete and proper installation of specified items, selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to work of this section, carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 INSTALLATION

A. Install toilet partitions and other items specified in this Section, anchoring components firmly in place for long life under hard use and in complete accordance with manufacturer's recommendations.

3.03 INSPECTION AND ADJUSTMENT

A. Upon completion of installation and as a condition of acceptance, visually inspect entire work of this section, adjust components for proper operation and straight alignment, and touch-up scratches and abrasions to be completely invisible.

END OF SECTION 10 21 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install metal accessories called for in Toilet Accessory Schedule.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Samples: Submit a sample of each component illustrating color and finish.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.04 REFERENCES

A. 2021 Arkansas Fire Prevention Code (IBC 2021), Chapter 11 - Accessibility.

B. BABIES Act, or Bathrooms Accessible In Every Situation Act (2016) requiring changing tables in all publicly accessible federal buildings as determined by the GSA.

C. 2017 ICC A117.1 - Accessible and Usable Buildings and Facilities.

D. 2010 ADA Standards for Accessible Design.

E. ADA Accessibility Guidelines for Buildings and Facilities, July 23, 2004 – Provisions for Children.

F. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

G. ASTM A167-99 (Re-approved 2004) - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

H. ASTM A269/A269M-2015 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

I. ASTM A794/A794M-2018 - Standard Specification for Commercial Steel (CS), Sheet, Carbon (0.16 % Maximum to 0.25 % Maximum), Cold-Rolled.

J. ASTM B456-2003 - Electro-deposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.05 QUALITY ASSURANCE

A. Use personnel skilled in work required, completely familiar with manufacturers' recommended methods of installation, and thoroughly familiar with requirements of this work.

1.06 PRODUCT HANDLING

A. Protection: Protect toilet and bath accessories before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

PART 2 - PRODUCTS

2.01 METAL TOILET ACCESSORIES

A. Manufacturers and Accessory Numbers are listed in Toilet Accessory Schedule. Manufacturers who may furnish products for review by Architect are:
1. American Specialties
2. Bobrick **(Basis-of-Design)**
3. Bradley
4. comfortdesigns
5. Delta Faucet
6. McKinney
7. Approved Equal

2.02 MATERIALS

A. Stainless Steel: AISI Type 302/304, with “Brushed” finish, 0.034-inch (22-gage) minimum thickness.

B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.

C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 527, G60.

E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

2.03 FASTENERS

A. Provide screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.04 PLUMBING PIPE WRAP

A. At all exposed lavatory piping, provide TRUEBRO Lav Guard® 2, Fast Fit Undersink Piping Covers as manufactured by IPS Corporation, 202 Industrial Park Lane, Collierville, TN 38017, 800-340-5969 or approved equal.
   1. Use at all sinks or lavatories that do not have removable apron.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Coordinate with other trades to ensure proper and adequate provision in framing and wall finish for installation of selected accessories.

B. Prior to installation, inspect location of accessories and verify that necessary provisions have been made. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' recommendations, anchoring components firmly in place.

END OF SECTION 10 28 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Firefighting devices consist of hand-portable fire extinguishers and metal cabinets, and accessories.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. NFPA 10 - Standard for Portable Fire Extinguishers

B. ADA Accessibility Guidelines

C. IBC/IFC Tables 906.3(1) and 906.3(2) for determining extinguisher rating, fire classification, hazard classification, and travel distance.

D. UBC Standard 7-5 (ASTM E-814-83) - Fire-rated cabinet option for combustible and non-combustible walls.

1.05 QUALITY ASSURANCE

A. Provide fire extinguishers, cabinets, and accessories by a single manufacturer.

1.06 PRODUCT HANDLING

A. Protection: Protect firefighting devices before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. **Basis of Design:** Larsen's Manufacturing Co., 7421 Commerce Ln NE, Minneapolis, MN 55432, (763) 571-1181 or (800)527-7367.
   2. Potter Roemer, 17451 Hurley St, City of Industry, CA 91744 Phone: (800) 366-3473 E-mail: info@potterroemer.com
   3. JL Industries, Activar Construction Products Group, 800-554-6077. Email: sales@activarcpg.com

B. Abbreviations:

SRC-1	Semi-Recessed Cabinet
WHE-1	Wall Hung Extinguisher (with clip or bracket)

2.02 FIRE EXTINGUISHERS

A. **Type 1:** Provide multi-purpose dry chemical type, Model MP-10 with UL Rating 4A-80B:C for Class A, B and C fires manufactured by Larsen's® or approved equal.
   1. Provide Optional Brackets where specified at additional cost and compatible with Larson extinguishers. Standard brackets are included with the cost of extinguisher.

2.03 FIRE EXTINGUISHER CABINETS

B. **SRC-1:** Construct cabinets from 18 gauge, or heavier, stainless steel with #4 finish. Provide Larsen's®, rolled edge semi-recessed "Architectural Series" No.SS2409-6R, or approved equal, with "Vertical Duo" doors. Lettering, if required, to be black vertical Type ‘A’ die cut; verify with Owner and local Authority Having Jurisdiction (AHJ) or fire code official (Note: lettering typically not required). Mount at 56" to top of housing in masonry wall construction, maintaining consistent height at all wall types. Neither the extinguisher handle nor the cabinet handle shall be mounted higher than 48" AFF, per ADA.

C. Provide fire rated cabinets if required to be installed in a fire rated wall.

2.03 EXTINGUISHER AND BRACKETS

A. **WHE-1:** Provide Extinguishers with Optional Bracket Model No. 808 MP10 wall brackets with baked enamel finish as manufactured by Larsen's® or approved equal.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Coordination: Coordinate with other trades to ensure proper and adequate provision in framing and wall covering for installation of recessed cabinets.

B. Inspection:
   1. Prior to installation, inspect cabinet recesses, and verify that necessary provisions have been made.
   2. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 INSTALLATION

A. Install the items of this Section in strict accordance with the original design, approved shop drawings, and requirements of agencies having jurisdiction, as approved by the Architect, anchoring all components firmly into position.

3.03 SERVICE

A. Determine approximate completion date of Work. Inspect, charge, and tag fire extinguishers at date not more than ten days before or less than one day before actual completion date of the Work.

END OF SECTION 10 44 00

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide phenolic Wardrobe and Box Lockers and accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Color Charts: Provide color charts showing manufacturer's standard available colors. Provide samples if requested.

D. Numbering: Locker numbering sequence will be provided by the approving authority and noted on approved shop drawings returned to the locker contractor.

1.04 QUALITY ASSURANCE

A. Provide each type of metal locker as a complete unit produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.

B. Warranty: Manufacturer warrants lockers against defects in materials and workmanship for a period of twenty (20) years from the date of substantial completion of the project.

C. Lockers shall be GREENGUARD Gold Certified through UL Environment’s GREENGUARD Certification Program, to include GREENGUARD Children & Schools Certified℠.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Do not deliver lockers until building is enclosed and ready for their installation. Protect from damage during delivery, handling, storage and installation. At Contractor's expense, replace damaged lockers or components.

1.06 WARRANTY

A. **20-Year Warranty:** Superior® VersaMax™ Solid Phenolic Lockers are covered against all defects in materials and workmanship excluding damage resulting from deliberate destruction and vandalism under this section for a period of 20 years.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide lockers as manufactured by one of the following:
   1. List Industries VersaMax™ (Basis of Design).
      Contact: Penny Leatherman, Regional Sales Manager, (615) 727-4213.
   2. Approved equal products meeting the specifications set forth below.

2.02 Z-LOCKER SIZES

A. Single Tier 18" Wide x 18" Deep x 72" High.

B. Double Tier 18" Wide x 18" Deep x 72" High.

2.03 FABRICATION

A. **Doors:** Shall be fabricated of 1/2" thick solid phenolic. Doors shall be the full width of the locker and shall be frameless, allowing access to the entire width of the locker. Framed doors are unacceptable. Plain doors with perimeter ventilation shall provide ventilation properties superior to that of traditional framed doors.

B. **Body:** Tops, bottoms, and shelves shall be made from 3/8" thick solid phenolic. Sides shall be made from 5/16" thick solid phenolic (backs 1/4" thick phenolic). Body components shall be white in color. Body incorporates mortise and tenon construction and shall be mechanically fastened together with stainless steel fasteners. Multiple width units will share intermediate sides and have unit width top, bottom, back and shelf/tier divider.

C. **Handle/Latch Assembly:** Hasp shall be fabricated of 11 gauge finger-pull Type 304 stainless steel with a satin finish. All edges shall be polished and smooth. Hasp shall be attached to the locker body with two (2) stainless steel theft proof torx head with pin, through bolts. Hasp shall extend through a slot in the face of the locker door. Handle shall be finger pull type. Doors are prepared for use with a padlock (sold separately).

D. **Hinges:** Hinges shall be 14 Gauge Type 304 Stainless Steel and shall have a black powder coat finish. Hinge shall have five (5) knuckles and shall be "Hospital" type with beveled top and bottom knuckles. Knuckles of Hinge shall be exposed to allow Door to open 180°.

E. **Equipment:** Furnish each locker with the following items, unless otherwise noted:
   1. Single tier locker openings 60" and 72" high shall include one hat shelf and a single coat rod fabricated of 11 gauge type 304 stainless steel attached to locker body with theft proof stainless steel hardware.
   2. Double tier locker openings 30" and 36" high and Z-tier locker openings shall include three (3) single prong hooks fabricated of 11 gauge type 304 stainless steel attached to locker body with theft proof stainless steel hardware.
   3. Locker openings 24" high and under shall not include hooks.
   4. All lockers shall include an engraved aluminum number plate fastened to the door with theft proof fasteners.

F. **Color:** To be selected from 18 standard designer colors from Formica.

G. **Construction:** Lockers shall be "**Superior VersaMax Phenolic Lockers**" as manufactured by List Industries Inc. or approved equal. Surface and edges shall be nonporous. Provide material which has been selected for uniform color, surface flatness and even texture. Exposed surfaces which exhibit discolorations, pitting, seam marks, roller marks, stains, telegraphing, or other imperfections on finished units are not acceptable

H. **Accessories:** Slope top, end panels, fillers, and base shall be manufactured of the same color, thickness and phenolic material as the locker doors.

I. **Toe Kick:** 4" high adjustable plastic legs with phenolic base fascia matching lockers and sloping hoods.

J. **Headers:** Top trim, where required, shall be 3" high maximum.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence. Verify that lockers may be installed in complete accordance with manufacturer's recommendations and conditions identified in Contract Documents. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

B. If actual field dimensions vary from dimensions shown on Drawings, notify Architect prior to commencing work.

3.02 INSTALLATION

A. Install lockers at locations shown in accordance with manufacturer's instructions for a plumb, level, rigid and flush installation.

B. **Placement:** Lockers shall be set in place, plumb, level, rigid, flush and securely attached to the wall (or bolted together if back-to-back) and anchored to the floor or base according to manufacturer's specifications.

C. **Anchorage:** About 48" o.c., unless otherwise recommended by manufacturer, and apply where necessary to avoid metal distortion, using concealed fasteners. Friction cups are not acceptable.

D. **Trim:** Sloping tops, fillers and end panels shall be installed using stainless steel fasteners.

3.03 ADJUSTMENT

A. Upon completion of installation, inspect lockers and adjust as necessary for proper door operation.

END OF SECTION 10 51 29

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Design, fabrication, and installation of extruded aluminum wall hung canopy cover systems.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Product Data: Manufacturer’s product information, specifications, and installation instructions for walkway cover components and accessories.
   2. Shop Drawings: Include plan dimensions, elevations, and details.
   3. Manufacturer’s full range of colors for the finishes selected.
   4. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Samples:
   1. Selection: Manufacturer's standard range of colors for the finishes selected.
   2. Verification: 2-inch-square samples of each finish selected on the substrate specified.

D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in the state where the project is located. Design calculations shall state that the canopy system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

1.04 REFERENCES

A. The Aluminum Association (AA):
   1. The Aluminum Design Manual 2010, Specifications & Guidelines for Aluminum Structures.

B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   4. American Society for Testing and Materials (ASTM):
      a. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
      b. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.05 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Design Canopies in accordance with The Aluminum Design Manual 2000.
   2. Comply with the wind requirements of ASCE 7.
   3. Provide aluminum system complete with internal drainage.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years experience in the design, fabrication, and erection of extruded aluminum canopy cover systems.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. Manufacturers:
   1. AVAdek Walkway Covers and Canopies, 9201 Winkler, Houston, TX 77017, 713-944-0988 or 800-777-4031.
   2. Mapes Canopies, Lincoln, NE, Phone: 1-888-273-1132. **(Basis-of-Design)**
      a. Super Lumideck Hangar Rod Canopy with 2-3/4" Corrugated Deck.
   3. Peachtree Protective Covers, Inc., 1477 Rosedale Drive, Hiram, GA 30141, 770-439-2120.
   4. Perfection Architectural Systems, LLC, 2310 Mercator Dr, Orlando, FL, Tel.: 800-238-7207
   4. Tennessee Valley Metals, Inc., 190 Industrial Park Road, Oreonta, AL 35121, 800-551-2579.
   5. Archetype Canopies, 5432 S 103rd E Ave, Tulsa, OK 74146, (918) 584-8449.
   6. MASA Architectural Canopies, (800) 761-7446 (ExtruDeck)
   7. Approved equal.

2.02 MATERIALS

A. Decking shall consist of an interlocking roll-form 2-3/4" x 6" x .078 roll formed interlocking aluminum decking.

B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current manufacturer's brochures.

C. Hanger rods and attachment hardware shall be a standard finish.

D. Fascia shall be standard extruded 8" Style "J" Fascia .125 thickness with 2" dia. Drain Hole and .032 aluminum Drainage Scupper (Field locate and install).

2.03 FABRICATION

A. All canopies shall be shipped in preassembled sections for ease of installation.

B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Front Scupper.

D. Finish shall be Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION

A. Erect canopy true to line, level, and plumb.

B. Provide hairline miters and fitted joints.

3.03 CLEANING

A. Clean all protective cover components promptly after installation.

3.04 PROTECTION

A. Protect materials during and after installation.

END OF SECTION 10 73 16

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide other miscellaneous specialties specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Furnish at least one person, present at all times, thoroughly familiar with installation requirements of each item, to personally supervise installation.

1.05 PRODUCT HANDLING

A. Protection: Protect miscellaneous specialty items before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements at Contractor's expense.

PART 2 - PRODUCTS

2.01 RAPID ENTRY SYSTEM

A. Provide Knox-Box® emergency entry key box by Knox Co., 949-252-8181, or approved equal. Provide Model #3274 Recess Mount in Dark Bronze color and #3290 Hinged Door Recessed Mounting Kit. Contractor to contact local fire department to apply for authorization to order box and verify location. Orders are not accepted without authorized signature of local fire official. Recommended mounting height is 72" to top of box to help deter vandalism. Verify with local Authority Having Jurisdiction (AHJ).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to installation, verify items may be installed in accordance with manufacturers' recommendations.

B. Notify Architect of conditions that would adversely affect installation.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install miscellaneous specialties in strict accordance with manufacturers' current recommendations and instructions.

3.03 ADJUSTMENT AND CLEANING

A. Verify that trim is in place and adjust components.

B. Remove labels from equipment and remove packing materials from job site.

END OF SECTION 10 80 00

PART 1 - GENERAL

1.01 SUMMARY

A. Provide manually-operated roll-up fabric interior window shades, including mounting and operating hardware.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

D. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section. If manufacturer does not meet minimum experience requirement, please submit life cycle test data showing minimum 2000 complete operational cycles for each year of warranty showing no failure and that shade remains fit for use as a operable shade.

B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use. Show complete manufacturer data (name, location, contact) and certification from manufacturer that the fabrics sourced for this project comply with the test data provided.

C. Mock-Up: Provide a mock-up of one of each type roller shade assembly specified for evaluation of mounting, appearance and accessories.
   1. Locate mock-up in window(s) designated by Architect.
   2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Label containers and shades according to Window Shade Schedule.

D. Store products in manufacturer's unopened packaging until ready for installation.

1.06 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

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

1.07 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.08 WARRANTY

A. Manufacturer to warrant its hardware components and shade fabric to be free from defects in material and workmanship under the normal and proper use for a period of twenty-five (25) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Draper, Inc.. Toll Free Tel: 800-238-7999.

B. All work regarding shades to be coordinated with Kavanaugh Blind Shade & Shutter Co., 5208 Kavanaugh Blvd, Little Rock, AR, (501) 412-6866 (mobile);
email: Brett Todd sbretttodd@outlook.com

C. Approved Dealers:
   1. Shop Mr. Blinds, Searcy, AR 501-232-8382, Mandy Lloyd.
   2. Baker Window Coverings, 501-529-2900, Janet Baker
   3. Other equal dealers will be subject to approval by the architect.

D. Approved equal manufacturers:
   1. Hunter Douglas
   2. SWF Contract (Springs Window Fashions)

2.02 MANUALLY OPERATED WINDOW SHADES

A. Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation.
   1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
      a. Clutch mechanism: Fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon. White or Black color as selected by Architect.
      b. Bead chain loop: Stainless steel bead chain hanging at side of window.
      c. Idler Assembly: Provide roller idler assembly of molded nylon with adjustable or spring-loaded length idler pin to facilitate easy installation, and removal of shade for service.
      d. Bead Chain Hold Down: P-Clip (standard).
   2. Mounting:
      a. Mounting brackets.
      b. End-caps and fascia.
   3. Roller Tube: Fabricated from extruded aluminum, galvanized steel, or enameled steel. Diameter, wall thickness, and material selected by manufacturer to accommodate shade type and size. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate horizontal impressions in fabric.
   4. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
      a. Endcap covers: To match fascia or headbox color.
   5. Brackets: Plated stamped steel. Provide size compatible with roller size.
      a. Mounted to jamb.
   6. Shade slat: Slat encased in heat seamed hem.
   7. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
      a. Attachment: Snaps onto end-caps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.
      b. Shape: Square Fascia Panel.
      c. Finish: Clear anodized.

2.03 FABRIC

A. Light-Filtering Fabrics
   1. Refer to the Product Schedule located in the drawings for locations, types, patterns and colors.
      a. Openness Factor: 3%
      b. Color: Charcoal

PART 3- EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

B. Coordinate requirements for blocking, construction of shade pockets, and structural supports to ensure adequate means for installation of window shades.

C. Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings specified in Section 09 51 00.

D. Coordinate installation of recessed shade pockets with construction of suspended gypsum board ceilings specified in Section 09 21 16.

E. Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Shade pockets:
   1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.

2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
3. Install corner pieces securely and in alignment with pockets.
4. Install pocket ends securely and in alignment with pockets.
5. After interior construction is essentially complete, install shade and operating mechanism in pocket.

D. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
1. Fascias.
2. Closure panels.
3. Endcaps.

E. Install headbox, side channels, and sill channel with sealant specified in Section 07 92 00 - Joint Protection.

F. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

3.04 TESTING AND DEMONSTRATION

A. Test window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.

B. During daylight hours, lower shades and turn off interior lights. Verify that there are no light leaks at perimeter or within shade assembly. Correct deficiencies.

C. Demonstrate operation of shades to Owner's designated representatives.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.06 SCHEDULES

A. Refer to Drawings for shade types and locations.

END OF SECTION 12 24 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish, deliver, and erect pre-engineered metal building structural components shown on drawings and conforming to these specifications.

B. Furnish building design of manufacturer regularly engaged in fabrication of pre-engineered structures.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Furnish Shop Drawings, for review by Architect showing necessary fabrication details, fittings, fastenings, foundation reactions for all load cases, anchorage and erection details. In addition to provisions of the General Conditions, prepare Shop Drawings by or under the supervision of a registered professional engineer. Do not use reproductions, in any form, of the Contract Drawings for Shop Drawings. Shop Drawings shall be submitted to Architect for review. Submit related shop drawings together; partial submittals will not be accepted. Furnish mill certificates on foreign steel proposed for use and not produced within the continental USA. Include with mill certificates certified copies of mill test reports giving names and locations of mills and shops, and chemical analysis and physical properties of steel required for this project.
   2. All drawings and calculations shall bear the stamp of a structural engineer licensed in the state of Arkansas.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCE STANDARDS

A. Conform to latest edition of the following standards where applicable to structural design of building:
   1. "Recommended Design Practices Manual", Latest Edition - Metal Building Manufacturer's Association.
   2. "Manual of Steel Construction", Latest Edition - American Institute of Steel Construction

3. "Cold Formed Steel Design Manual", Latest Edition - American Iron and Steel Institute.
4. "Aluminum Construction Manual", Latest Edition - The Aluminum Association.
5. "Code for Welding in Building Construction", Latest Edition - American Welding Society.

1.05 DESIGN LOADS

A. General: Basic design loads include live, wind, and dead loads. Other loads, whether of static, dynamic, or kinetic nature, are considered auxiliary loads.

B. Refer to Pre-Engineered metal building notes on Structural Drawings for Roof Live Load, Roof Dead Load, Superimposed Roof Dead Load, Roof Deflections, Perimeter Wall Deflections, Drift Under Wind Loading and other loading requirements.

C. Certification:
1. Submit letter from metal building manufacturer certifying that the building proposed will be furnished to meet or exceed all the above design load criteria and that all structural design will be in strict conformance with that prescribed in the MBMA "Design Practices Manual".
2. After awarding of Contract, submit complete structural analysis prepared by metal building manufacturer to Architect upon request for same.

1.06 GUARANTEES

A. Provide one year labor and material warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide pre-engineered structural system by or one of the following manufacturers or approved equal.
1. Alliance Steel
2. American Buildings Company
3. Architectural Integrated Metals
4. Butler Manufacturing Company
5. Pinnacle Structures
6. Varco Pruden
7. Approved equal

2.02 PRE-ENGINEERED STRUCTURAL SYSTEM

A. Primary Structurals: Frames will consist of welded up plate section columns and roof beams or trusses complete with necessary splice plates for bolted field assembly. All bolts for field assembly of primary framing will be high strength bolts as indicated on erection drawings.

B. Beam and post endwall frames will consist of endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.

C. Exterior columns will be welded-up "H" sections or cold-formed "C" sections; interior columns will be "H" sections or tube columns.

D. Connection of all major structural members will be made with A 325 high-tensile bolts through prepunched or predrilled holes for exact alignment.

2.03 ROOF COVERING SUPPORTS AND ACCESSORIES

A. Roof Panel System, by others, able to be fastened to purlins with concealed steel clip or steel backing device having a protective metallic coating. Through penetration of roofing surface by exposed fasteners is not allowed. Refer to Division 7 for specified roof panels.

B. Purlins Configuration, Thickness, and Spacing: Use building manufacturer's standard, provided design criteria, including deflection, is met or exceeded.

2.04 WALL COVERING SUPPORTS

A. Girt Configuration and Thickness: Provide building manufacturer's standard design criteria, to include meeting deflection and girt spacing as detailed on the drawings.

2.05 STRUCTURAL STEEL PRIMER

A. Give all un-coated structural steel 1 shop coat rust-inhibitive (primer) paint which meets or exceeds Federal Specifications TT-P-664, or submit certification that it conforms to a recognized authoritative specification, such as a Federal or Military authority or the Structural Steel Painting Council.

2.06 LINER PANELS

A. Interior wall paneling to be VP LPR-36, 36 inch wide 28 gauge with 1-1/4” high ribs screwed to framing with self-drilling fasteners. Provide partial-height liners attached to 7'-4" high girt, extending 2" above girt. Attach bottom of panel to base girt or channel as a component of the metal building system or as required. Liner panel to be ASTM A653 Grade 33 steel with a zinc coating. The panel is painted with a white polyester finish on one side and a gray primer coating on the second side. Approved equal product will be considered.

PART 3 - EXECUTION

3.01 GENERAL

A. Deliver and erect the pre-engineered components specified and complying with manufacturer's erection drawings and specifications.

B. Perform assembly and erection by the manufacturer's own crew or by an erector trained and authorized by the manufacturer with the erectors work being inspected and certified by the manufacturer.

3.02 ERECTION

A. Bolt settings and other dimensions shall be held to a tolerance of 1/8-inch±. Use templates or other gaging devices to assure accurate spacing of anchor bolts. Bolt field connections unless otherwise required.

1. Set bases or sill members to obtain uniform bearing. Anchors and anchor bolts for securing members to concrete curb or structural steel sub-frame shall be of black steel, set accurately to templates and of proper size to adequately resist applicable design loads at the base.

END OF SECTION 13 34 19

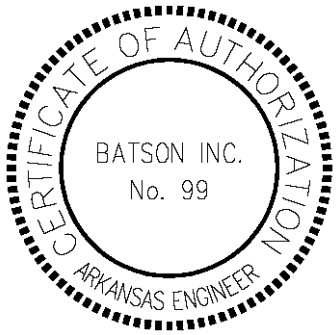
SPECIFICATIONS: DIVISIONS 21, 22 & 23

PROJECT: CRAIGHHEAD ELECTRIC COOPERATIVE
MAINTENANCE SHOP ADDITION – JONESBORO, AR

DATE: February 14, 2025

BATSON INC. PROJECT NO.: 6106

Marc W. White, P.E.



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PART 1 - GENERAL

1.01 GENERAL:

A. The work outlined in this section shall be a part of the General Contract. The General Conditions, Supplementary General Conditions, and Information for Bidders apply to and are parts of this Section.

B. The work shall include necessary labor, materials, appliances, and equipment to install complete fire protection system in accordance with these specifications with no additional cost to the Owner unless the scope of the building changes.

1.02 RELATED SECTIONS: Sections 21 13 13 Fire Protection Sprinkler Systems.

A. Refer to other sections for other requirements.

B. Refer to drawings for additional scope of work and areas.

1.03 GOVERNING AGENCIES, CODES, PERMITS, AND INSPECTIONS:

A. Work shall comply with the national fire codes as published by the National Fire Protection Association, state and local codes.

B. The Contractor shall obtain necessary permits required, paying fee therefore.

C. The Contractor shall give required notice to the proper authorities relating to work under his charge and shall afford the Engineer and authorized inspectors every facility for inspection.

D. Upon completion of the work, contractor shall obtain certificates of inspection and approval from the governing authority and deliver 3 copies to the Engineer.

1.04 QUALIFICATIONS OF CONTRACTOR:

A. Fire protection systems shall be installed by a licensed contractor with a specialty in automatic sprinkler and fire protection systems.

B. Specialty contracting license shall have to be in force for no less than 5 years.

1.05 SUBMITTAL AND "AS-BUILTS":

A. Before commencing the fabrication of installation of the fire protection system, submit

working plans and equipment cuts to the governing authority.

B. Submit the approved plans and equipment cuts to the Engineer for concurrence. This submittal shall bear the governing authorities approval stamp.

C. At the completion of the work, the Contractor shall supply the Engineer with 3 sets of approved drawings and equipment cuts. At least one set shall bear the approval stamp of the governing authority. These sets shall be "As-Builts" and shall reflect changes made during construction.

1.06 GUARANTEE AND SERVICE:

A. The entire fire protection installation, as specified and/or installed under this section of the specifications, shall be guaranteed for one year against defective equipment, materials, and workmanship. The guarantee period is to begin on the date the building is accepted by the Owner, as attested by final payment or substantial completion from, whichever is earlier.

B. During the one-year guarantee period, the Contractor shall perform service as required.

PART 2 – PRODUCTS

2.01 All materials shall be as approved by NFPA, Owners insurance carrier, and local authorities.

PART 3 – EXECUTION

3.01 SEISMIC: Provide seismic restraints as indicated in NFPA and state code for seismic design category 'D'.

3.02 FIRE/SMOKE STOPPING: Provide fire and smoke stopping at the penetrations of rated assemblies by the fire protection system with U.L. rated and listed materials as directed in the architectural portions of the specifications.

3.03 BACKFLOW PREVENTION: Provide system backflow prevention as required by local and state regulations and as indicated by these specifications and drawings.

3.04 FREEZE PROTECTION

A. Ensure all wet systems will not freeze.

B. Review architectural drawings and identify freezing location. Confirm freeze protection requirements with Architect/Engineer prior to bidding.

C. Provide freeze proof systems where necessary, and as indicated.

1. Unheated entry and exits
2. Roof installations
3. Unheated stairways
4. Unconditioned enclosed spaces
5. Unheated elevator shafts
6. Unheated mechanical and electrical rooms

3.05 Do not install fire lines directly above electrical equipment.

3.06 FIRE ALARM

A. Interface all alarms and monitors with the fire alarm system.

B. Demonstrate that each system is interfaced properly with fire alarm system.

3.07 TESTING

A. System test shall be performed in the presence of the Owner and/or Engineer.

3.08 TRAINING

A. Provide 2 hours training for Owner's staff in the operation, maintenance, and required testing of the systems.

END OF SECTION 21 11 00

PART 1 - GENERAL

1.01 See Section 21 11 00 - Fire Protection, General, for applicable requirements.

1.02 The work under this section shall include necessary labor, materials, appliances, and equipment to install complete automatic sprinkler system in accordance with the plans and specifications with no additional cost to the Owner unless scope or use of building changes.

1.03 DESIGN AND INSTALLATION STANDARDS:

A. NFPA Pamphlet No. 13 - Sprinkler Systems.

B. NFPA Pamphlet No. 24 - Outside Protection.

C. Other NFPA pamphlets as may apply.

D. Publications by governing authority as may apply.

E. Applicable UL publications.

1.04 BID DOCUMENT PLANS:

A. Plans issued as a part of these bid documents are diagrammatic, indicating suggested location of risers that must be coordinated with building construction and Owner's space allocation requirements.

B. The Contractor shall design a fire protection sprinkler system based on NFPA requirements for occupancy, and insurance authority as applicable.

C. Contractor shall be responsible for provision of all other phases in the contract documents such as mechanical, structural, electrical and architectural systems and shall design to facilitate all features of the building while complying with NFPA, and insurance authority as applicable.

D. Any conflict between the governing authority and the plans and specifications shall be called to the attention of the Engineer at least 72 hours prior to bidding. Any conflicts not called out to the Engineer, and corrected by Addendum shall be bid and installed according to the most stringent requirement.

1.05 Coordinate closely with fire alarm and electrical power systems for special use areas such as elevators, computer rooms, and electrical equipment rooms.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. All materials, equipment, valves, and devices installed and/or furnished under this Section shall be listed and/or approved for use in the fire protection installation by the authorities, agencies, codes and standards of the governing agencies, and as permitted by NFPA.

B. UNDERGROUND PIPING:

1. Class 250 psi cement lined ductile iron or PVC or reinforced PVC and in compliance with minimum standards of local authority.

2. Fittings shall have joints and pressure class rating compatible with the pipe used.

C. Above ground system components shall comply with NFPA Pamphlet No. 13, and insurance authority as applicable.

D. Concealed sprinkler heads shall be used. Color of associated cover plates to be coordinated with architect.

E. Fire department siamese connections shall have two 90°, 2-1/2" fire department inlets with female hose connections, American National Fire Hose connection screw threads, with self-closing brass double clapper valves, with plugs and chains, in polished brass finish. Verify hose coupling threads with local fire department.

F. Provide extra sprinkler heads with cabinet. Provide 1% of each type of head installed with a minimum of one and a maximum of 10 of each type.

G. Water flow indicators shall be vane type water flow detectors, of size as required. Provide terminals from dry contacts in box for connection by others.

H. Supervisory switches shall be installed on all sectional valves. Provide terminals from dry contacts in box for connection by others.

PART 3 - EXECUTION

3.01 Comply with the requirements of the governing authority and NFPA No. 13 for installation of fire sprinkler piping materials. Install fire sprinkler piping products where indicated, in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that fire sprinkler piping complies with requirements and serves its intended purpose.

3.02 Coordinate with other work as necessary to interface components of fire sprinkler piping properly with other work. All sprinkler piping shall be concealed in building construction where possible. Where exposed, contractor shall paint piping (color per architect).

3.03 Discharge test drains so as not to interfere with building use when opened.

3.04 Where heads are installed in a patterned ceiling, locate in center of panels. All head locations are to be approved by Architect. Heads are to be placed symmetrically and in center of ceiling with modifications as necessary along center line for mechanical, electrical, and architectural devices in the ceiling.

3.05 Apply signs to control, drain, test and alarm valves to identify their purpose and function. Provide lettering size and style selected by Engineer from NFPA's suggested styles.

3.06 Systems shall be cleaned and tested in accordance with governing authority and NFPA No. 13.

3.07 Anchor and restrain underground pipe in accordance with NFPA Pamphlet No. 24.

3.08 PIPE HANGING:

A. Pipe hangers and spacing shall conform to NFPA No. 13.

B. Provide all auxiliary steel to carry the dead weight and dynamic load imposed by the piping.

C. Design all auxiliary steel to carry the dead weight and dynamic load imposed by the piping.

D. Any connection to the structural steel must be done in a manner as not to overload the structural steel.

E. Where piping is supported off a concrete structure, inserts shall be used. In cases where pipes are supported from existing slab, use Phillips "Red Head" or equal, sized for Safety Factor 4.

F. Power driven studs and welding studs shall not be used.

G. Where 5", 6", and 8" pipe is supported from bar joist each hanger shall be supported by at least two joists. Keep piping this size within 5' of column lines.

3.09 EXCAVATION, TRENCHING, AND BACKFILLING:

A. Fire protection water piping shall not be installed in mutual trenches with other piping or electrical.

B. Depth of bury shall be in accordance with the requirements of the governing authorities

and NFPA. In no case shall the depth of cover be less than 30 inches in open areas, 36 inches under drives or parking lots and 48 inches under railroads. Sleeve all piping under railroads.

C. All excavation, trenching and backfilling in connection with the fire protection systems is included as part of this specification.

D. All excavation required shall be done as part of the bid price regardless of any implied conditions on drawings or in these specifications.

E. Excavation to have 12" minimum clearance on all sides. Do not carry excavation below required level unless otherwise indicated on drawings. Excess excavation below required level shall be backfilled at no expense to Owner with earth, sand, gravel, or concrete, as directed by Engineer and thoroughly compacted. Remove any unstable soil and replace with gravel, crushed stone or clean sand and thoroughly compact. Engineer will determine the depth of removal of any unstable soil encountered. Grade ground adjacent to excavations to prevent water running in. Remove, by pumping or other means, any water accumulated in excavation.

F. Banks of trenches shall be vertical or as indicated on drawings. Width of trench to be 5" minimum, 8" maximum on each side of pipe bell. In rock, excavations shall be carried 8" below bottom of pipe. Use loose earth or gravel for backfill and tamp thoroughly.

G. Bracing, sheathing and shoring shall be performed as necessary to complete and protect excavations, as required for safety, or to conform to governing laws.

H. After piping has been installed, inspected, tested, and approved by governing agency, backfill trenches with clean, stable soil free from stones. Place backfill in 4" layers, tamped under and around pipe to height of at least 2' above pipe. Tamping shall be done in such manner as not to disturb underlying work. Remainder of trenches and excavations shall be backfilled with clean, stable earth, deposited in 8" layers and brought up to rough grade, with each layer compacted to density of surrounding soil. Remove sheathing and shoring as backfill is placed and fill space with dry sand. Compaction tests may be required by the Engineer, with the costs paid by the contractor.

I. Replace existing paving and appurtenances removed or damaged in connection with work, and restore to original conditions, unless otherwise directed.

3.10 Terminate all test drains outside, or at floor drains or other fixtures as indicated, where water will not be objectionable.

3.11 ELECTRICAL EQUIPMENT SPACES AND REMOTE GEAR

A. Do not run sprinkler piping above electrical equipment per the National Electrical

Code.

3.12 FREEZE PROTECTION

A. Ensure all wet systems will not freeze.

B. Review architectural drawings and identify freezing location. Confirm freeze protection requirements with Architect/Engineer prior to bidding.

C. Provide freeze proof systems where necessary, and as indicated.
   1. Unheated entry and exits
   2. Roof installations
   3. Unheated stairways
   4. Unconditioned enclosed spaces
   5. Unheated elevator shafts
   6. Unheated mechanical and electrical rooms

D. Dry Pipe System
   1. Provide dry pipe system where indicated on the drawings.
   2. Provide freeze proof Drum Drips. Provide with heat tape and insulation. Refer to division 22 of these specifications. Coordinate requirements and locations with the electrical contractor.
   3. Provide air compressors and control system for dry pipe system. Coordinate power requirements for compressor with the electrical controls contractor.

3.13 FIRE ALARM

A. Interface all alarm and monitoring devices with fire alarm system.

B. Demonstrate that each system is properly interfaced with fire alarm systems.

3.14 TESTING

A. Systems test and demonstration shall be performed in the presence of Owner.

B. Test the interface with the fire alarm system.

3.15 TRAINING

A. Provide two hours of training for the Owner's staff in the operation, maintenance, and required testing of the systems.

END OF SECTION 21 13 13

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Sleeve-seal systems.
   3. Grout.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

2.02 SLEEVE-SEAL SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade and Interior Floors, Partitions, Roofs, and Walls:
   b. Piping NPS 10 and smaller: Cast-iron wall sleeves.

END OF SECTION 22 05 17

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Bronze gate valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.02 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.03 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Solder Joint: With sockets according to ASME B16.18.

2.02 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Valve, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Crane Co.; Crane Valve Group; Crane Valves.
   d. Hammond Valve.
   e. Lance Valves; a division of Advanced Thermal Systems, Inc.
   f. Legend Valve.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Red-White Valve Corporation.
   j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded.
   f. Seats: PTFE or TFE.
   g. Stem: Bronze.
   h. Ball: Chrome-plated brass.
   i. Port: Full.

2.03 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
   a. American Valve, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.

c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. Kitz Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Red-White Valve Corporation.
k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
l. Zy-Tech Global Industries, Inc.

2. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: solder joint.
   e. Stem: Bronze.
   f. Disc: Solid wedge; bronze.
   g. Packing: Asbestos free.
   h. Handwheel: Malleable iron.

2.04 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Flo Fab Inc.
   e. Hammond Valve.
   f. Kitz Corporation.
   g. Legend Valve.
   h. Milwaukee Valve Company.
   i. NIBCO INC
   j. Powell Valves.
   k. Red-White Valve corporation.
   l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   m. Zy-Tech Global Industries, Inc.
2. Description:
   a. Standard: MSS SP-70, Type I
   b. CWP Rating: 200 psig (1380kPa).
   c. Body Material: ASTM A 126, gray iron with bolted bonnet.
   d. Ends: Flanged.
   e. Trim: Bronze.

f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.01 VALVE INSTALLATION

A. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.02 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: solder-joint valve.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Threaded valve-end option.

3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: provided with solder-joint ends.
2. Ball Valves: Two piece, full port, bronze with bronze trim.
3. Bronze Gate Valves: Class 125, NRS.

B. Pipe NPS 2-1/2 to NPS 4 (DN 65 to DN 100)

1. Iron Valves: Provide with threaded or flanged ends.
2. Iron Gate Valves: Class 125, NPS

END OF SECTION 22 05 23

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe positioning systems.
6. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
3. Trapeze pipe hangers.
4. Equipment supports.

C. Welding certificates.

1.04 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.06 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.07 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb (340 kg).
      b. Medium (MSS Type 32): 1500 lb (680 kg).
      c. Heavy (MSS Type 33): 3000 lb (1360 kg).
   8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

PART 1 - GENERAL

1.01 DESCRIPTION

A. Intent
1. All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
2. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
3. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.
4. All such systems must be installed in strict accordance with seismic codes, component manufacturer=s and building construction standards. Whenever a conflict occurs between the manufacturer=s or construction standards, the most stringent shall apply.
5. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
6. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
7. Seismic restraints shall be designed in accordance with seismic force levels as detailed in section 1.0.6.

B. The work in this section includes, but is not limited to the following:
1. Vibration isolation for piping, ductwork and equipment.
2. Equipment isolation bases.
3. Flexible piping connections.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Certification of seismic attachment of housekeeping pads.
8. All mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification).

AC Units Chillers Fans Tanks

		(All types)	(All types)
Air Distrib. Boxes	Compressors	Generators	Transformers
Air Handling Units	Comp. Room	Units Heat Exchangers	Unit Heaters
Air Separators	Condensers	Light Fixtures*	Unit Subastion
Battery Racks*	Condensing Units		Motor ControlCtrs.

*Var. Freq.

Boilers	Conduit*	Piping	Drives*
Bus Ducts*	Cooling Towers	Pumps(all types)	Water Heater
Cabinets Heaters	Ductwork		Rooftop Units
Cable Trays*	Electrical Panels	Switch Gerar*	

*Solid Bracing Only

C. Definitions
   1. Life Safety Systems:
      a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
      b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
      c. All medical and life support systems.
      d. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
      e. All life safety equipment has an asterisk on the equipment schedule.
   2. Positive Attachment:
      A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided AC@ type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic attachment.
      a. points.
   3. Transverse Bracing:
      a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
   4. Longitudinal Bracing:
      a. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

1.02 SUBMITTAL DATA REQUIREMENTS

A. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:
   1. Descriptive Data:
      a. Catalog cuts or data sheets on vibration isolators and specific restraints

detailing compliance with the specification.

b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.

2. Shop Drawings:

   a. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
   b. Provide all details of suspension and support for ceiling suspended equipment.
   c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers= submittals must include spacing, static loads and seismic loads at all attachment and support points.
   d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

3. Seismic Certification and Analysis:
   a. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
   b. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45E to the weakest mode.
   c. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in section 1.06 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

1.03 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable codes and Standards

1. The international building code, IBC – 2012 as published by the international code council.

2. The Arkansas Plumbing code, 2018

1.04 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
   1. Determine vibration isolation and seismic restraint sizes and locations.
   2. Provide vibration isolation and seismic restraints as scheduled or specified.
   3. Provide calculations and materials if required for restraint of unisolated equipment.
   4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.05 RELATED WORK

A. Housekeeping Pads
   1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
   2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel
   1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.

C. Attachments
   1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.06 SEISMIC FORCE LEVELS

A. The following force levels will be used on this project.

MINIMUM F_p (G=s) FORCES EQUAL TO OR EXCEEDING BUILDING CODE

LIST IN 1.03.

IBC-2000 TI-809-04 IBC-2003 NFPA-5000	"G" Forces for High Deformability Pipe, Bus Ducts, Conduits & Cabletrays a_p*=1.0, R_p*=3.5		"G" Forces for Rigidly Mounted Equipment & Limited Deformability Pipe a_p*=1.0, R_p*=2.5		"G" Forces for Vibration Isolated Equipment & Pipe Pressure Vessels a_p*=2.5, R_p*=2.5		"G" Forces for Low Deformability Pipe a_p*=1.0, R_p*=1.25	
Ss = 1.56	Horiz.	Vert.	Horiz.	Vert.	Horiz.	Vert.	Horiz.	Vert.
Lower Levels and Ground Level	0.50	0.33	0.50	0.33	0.67	0.33	0.53	0.33
Above Ground Level up to 1/4 of the Height of the Building	0.50	0.33	0.50	0.33	1.00	0.33	0.80	0.33
Above 1/4 up to 1/2 of the Height of the Building	0.50	0.33	0.53	0.33	1.34	0.33	1.07	0.33
Above 1/2 up to 3/4 of the Height of the Building	0.50	0.33	0.67	0.33	1.67	0.33	1.34	0.33
Above ¾ of Height of Building up to the Roof	0.57	0.33	0.80	0.33	2.00	0.33	1.60	0.33

*See definitions on page 1, SVCS-110, Part 1.

See instructions on page 5, SVCS-110, Part 1. Add data as required for a particular project. Use only one code per project and add the data on the appropriate line. Codes that are not applicable should be omitted to avoid confusion.

Table 1.06-1

PART 2 - PRODUCTS

2.01 INTENT

A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. Mason Industries' products are the basis of these

specifications; products of other manufacturers are acceptable provided their systems strictly comply with the specification and have the approval of the specifying engineer. Submittals and certification sheets shall be in accordance with section 1.02.

B. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater that ¼" (6mm).

2.02 PRODUCT DESCRIPTIONS

A. Vibration Isolators and Seismic Restraints.

SPECIFICATION:

1. Two layers of 3/4" (19mm) thick neoprene pad consisting of 2" (50mm) square waffle modules separated horizontally by a 16 (1.5mm) gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be type Super W as manufactured by Mason Industries, Inc.
2. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" (5mm) and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Preapproval “R”Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be type BR as manufactured by Mason Industries, Inc.
3. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be type PB as manufactured by Mason Industries, Inc.
4. A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be type HG as manufactured by Mason Industries, Inc.
5. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" (6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less

than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be type SLF as manufactured by Mason Industries, Inc.

6. Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Restraining Bolts shall have a neoprene bushing between the bolt and the housing. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad.Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Preapproval "R " Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings. Mountings shall be type SLR or SLRS as manufactured by Mason Industries, Inc.
7. Spring mountings as in specification 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4" (6mm) travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Preapproval "R" number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be type SSLFH as manufactured by Mason Industries, Inc.
8. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8" (3mm). Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be type MT and leveling valves type LV as manufactured by Mason Industries, Inc.
9. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be type SLR-MT as manufactured by Mason Industries, Inc.
10. Hangers shall consist of rigid steel frames containing minimum 1 1/4" (32mm)

thick neoprene elements at the top and a steel spring with general characteristics as in specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30deg. arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30 deg. capability. Hangers shall be type 30N as manufactured by Mason Industries, Inc.

10A. Hangers shall be as described in 10, but they shall be supplied with a combination rubber and steel rebound washer as the seismic upstop for suspended piping, ductwork, equipment and electrical cabletrays. Rubber thickness shall be a minimum of 1/4" (6mm). Submittals shall include a drawing of the hanger showing the installation of the rebound washer. Hangers shall be type RW30N as manufactured by Mason Industries, Inc.

11. Hangers shall be as described in 10, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30 deg. capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc.

12. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables must be prestretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Preapproval “R” Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.

13. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval “R” number from OSHPD in the state of California verifying the maximum certified load ratings. Solid seismic brace assemblies shall be type SSB, SSBS or SSRF as manufactured by Mason Industries, Inc.

Note: Specifications 12 - 14 apply to trapeze as well as clevis hanger locations.

At trapeze anchor locations piping must be shackled to the trapeze. Specifications apply to hanging equipment as well.

14. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Rod clamp assemblies shall be type SRC or UC as manufactured by Mason Industries, Inc.
15. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.
16. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4" (6mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm^2). A minimum air gap of 1/8" (3mm) shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Snubber shall be type Z-1225 as manufactured by Mason Industries, Inc.
17. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" (19mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm^2). Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" (3mm) nor more that 1/4"(6mm). Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8" (9mm) deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable" G" force. Submittals shall include the load deflection curves up to 1/2" (12mm) deflection in the x, y and z planes. Snubbers shall have an anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be type Z-1011 as manufactured by Mason Industries, Inc.
18. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is Arolled up@ to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be type SAS as manufactured by Mason Industries, Inc.
19. Female wedge anchors are preferred in floor locations so isolators or equipment

can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be type SAB as manufactured by Mason Industries, Inc.

20. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14" (350mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1" (25mm). Bases shall be type WF as manufactured by Mason Industries, Inc.
21. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6" (150mm). The base depth need not exceed 12" (300mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" (12mm) bars welded in place on 6" (150mm) centers running both ways in a layer 1 2" (38mm) above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" (25mm) clearance below the base. Wooden formed bases leaving a concrete rather then a steel finish are not acceptable. Base shall be type BMK or K as manufactured by Mason Industries, Inc.
22. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal or structural steel sections containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4" (6mm) thick. Steel springs shall be laterally stable and rest on 1/4" (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous flexible flashing nailed over the lower curbs waterproofing. All spring locations shall have accessibility to adjust springs. Lower curbs shall have provision for 2" (50mm) of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit must be solidly fastened to the top floating rail, and the lower section anchored to the roof structure. Curb shall have anchorage pre-approval “R” from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load

ratings. Curb shall be type SRSC or RMSS as manufactured by Mason Industries, Inc.

22A. Curb mounted rooftop equipment shall be mounted on top of Rigid Seismic Roof curbs. Curb sections shall be designed by an engineer licensed in the state where the project is, and shall be either structural steel channels or 12-gauge sheet metal. Field assembled joints are to include a minimum of 2 rows of 3 bolts at each connection. Curb to have a factory installed wood nailer. The Rooftop unit must be fastened to the curb and the curb fastened to the structure to resist both seismic and wind forces. Submittal shall include calculations by a professional engineer licensed in the state, and the engineer shall have a minimum of 5 years experience in seismic applications. Curb details and unit connection to curb details shall be included. Mounting hardware for unit to curb attachment will be provided by the installing contractor. Curbs shall be type RRC as manufactured by Mason Industries, Inc. Curb shall match slope of the supporting structure.

23. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar7 tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" (50mm) and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16"(400mm) to 24" (600mm) may be single sphere. Sizes :@ (19mm) to 12@ (38mm) may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi up to 170deg.F with a uniform drop in allowable pressure to 215 psi at 250deg F in sizes through 14" (350mm). 16" (400mm) through 24" (600mm) single sphere minimum ratings are 180 psi at 170deg F and 150 psi at 250deg. F . Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.

    Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have ½" (12mm) thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi (.7 kg/mm^2) maximum on the washer area.

    Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be type SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

24. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

Flanged

3" x 14" (75 x 350mm) 6" x 20" (150 x 500mm) 12" x 28" (300 x 700mm)
4" x 15" (100 x 375mm) 8" x 22" (200 x 550mm) 14" x 30" (350x750mm)

5" x 19" (125 x 475mm) 10" x 26" (250 x 650mm) 16" x 32" (400 x 800mm)

Male Nipples

1/2" x 9" (12 x 225mm) 1 1/4" x 12" (32 x 300mm) 2" x 14" (50 x 350mm)
3/4" x 10" (19 x 250mm) 1 1/2" x 13" (38 x 325mm) 2 1/2" x 18" (64x 450mm)
1" x 11" (25 x 275mm)

Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS as manufactured by Mason Industries, Inc.

25. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" (12mm) thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi (.35 kg/mm^2) and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.
26. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" (12mm) thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of +/- 5/8" (41mm) motion, or to meet location requirements. Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.
27. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" (19mm) thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" (25mm) past either face of the wall. Where temperatures exceed 240deg. F, 10# (4.5kg) density fiberglass may be used in lieu of the sponge. Seals shall be type SWS as manufactured by Mason Industries, Inc.
28. The horizontal thrust restraint shall consist of a spring element in series with a

neoprene molded cup as described in specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" (6mm) movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be type WBI/WBD as manufactured by Mason Industries, Inc.

29. Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor shall be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping pad anchors shall be attached to the structural slab using a stud wedge anchor. Housekeeping pad anchors shall be type HPA and stud wedge anchor shall be type SAS both as manufactured by Mason Industries, Inc.

PART 3 - EXECUTION

3.01 GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. “Building” includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractors expense.

G. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be

at the responsible contractors expense.

H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractors expense.

I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
   1. Flanges of structural beams.
   2. Upper truss cords in bar joist construction.
   3. Cast in place inserts or wedge type drill-in concrete anchors.

J. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

K. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.

L. At locations where specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with specification 14 braces.

M. At locations where specification 12 cable restraints are installed on support rods with spring isolators, the spring isolation hangers must be specification type 10A.

N. At all locations where specification 12 or 13 restraints are attached to pipe clevis, the clevis cross bolt must be reinforced with specification type 15 braces.

O. Drill-in concrete anchors for ceiling and wall installation shall be specification type 18, and specification type 19 female wedge type for floor mounted equipment.

P. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.

Q. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification 23 capabilities.

R. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification 27 wall seals.

S. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type 28 (see selection guide).

T. Locate isolation hangers as near to the overhead support structure as possible.

U. All fire protection piping shall be braced in accordance with NFPA 13 and 14.

V. All mechanical equipment shall be vibration isolated and seismically restrained as per the schedules in part 4 of this specification.

W. All fire protection equipment is considered life safety equipment and shall be seismically restrained using the seismic force levels for life safety equipment in table 1.06-1, if higher levels are shown.

3.02 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF PIPING

A. Horizontal pipe isolation: The first four pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10 & 10A. Floor supported piping shall rest on isolators as described in specification 6. Heat exchangers and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" (19mm) deflection for pipe sizes up to and including 3" (75mm), 1 1/2" (38mm) deflection for pipe sizes up to and including 6" (150mm), and 2 1/2" (64mm) deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Hanger locations that also have seismic restraints attached must have type RW Rebound Washers to limit uplift. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Riser isolation: Risers shall be suspended from specification 10A hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with specification 26 sliding guides. Steel springs shall be a minimum of 0.75" (19mm) except in those expansion locations where additional deflection is required to limit load changes to +/- 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

C. Seismic Restraint of Piping
   1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.
      a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping

that is 1" (25mm) I.D. or larger.
b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" (32mm) I.D. and larger.
c. All other piping 2 1/2" (64mm) diameter and larger.

2. Transverse piping restraints shall be at 40' (12m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
3. Longitudinal restraints shall be at 80' (24m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
5. For fuel oil and all gas piping transverse restraints must be at 20' (6m) maximum and longitudinal restraints at 40' (12m) maximum spacing.
6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" (600m) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
8. Branch lines may not be used to restrain main lines.
9. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in areas with Ss of 0.35 or greater shall be braced as in sections 3.02.C.2 and 3. For areas with Ss less than 0.35, 2 band clamps may be used with a reduced spacing of 1/2 of those listed in sections 3.02.C.2 and 3.
10. Connection to the structure must be made with a non-friction connection (i.e. no AC@ clamps)
11. Hanger locations that also have seismic restraints attached must have Specification 10A type RW Rebound Washers.
12. Piping which crosses building expansion joints shall be anchored on each side of the joint. Ball joints or braided hose assemblies shall be employed to allow the specified movement of the building without affecting the integrity of the piping system.

D. Pipe Exclusions
1. Gas piping less than 1" (25mm) inside diameter.
2. Piping in boiler and mechanical rooms less than 1 1/4" (32mm) inside diameter.
3. All other piping less than 2 1/2" (64mm) inside diameter.
4. a. All piping suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12" or less.
b. All trapezed piping where the distance from the suspension point to the trapeze member is 12" or less.
c. If any suspension location in the run exceeds the above, the entire run must be braced.

PART 4 - SCHEDULES

4.01 EQUIPMENT ISOLATOR AND SEISMIC RESTRAINT SCHEDULE

	Vibration Isolation and/or Seismic Restraint	
Equipment Schedule	Specification *	Static Deflection *
Water Heaters (WH-1)	4, 19, Model W Friction PAD, 4"x 4" angle iron provided by others	0

*If static deflection isn't listed, then the product does not require resilient mounts, or spring hangers.

*Where no specification numbers are listed, or where equipment is attached to mounting bases, curbs or rails, the equipment identified still is required to be restrained. Mason Industries will provide engineering calculation, and details. Mounting hardware will be provided by others.

4.02 EXCLUSIONS:

A. Equipment connected to the duct system shall be restrained if the equipment weighs more than 50 lbs. Equipment weighing more than 20 lbs., and is connected flexibly to the ductwork, shall be seismically restrained. Any equipment weighing less than 20 lbs. is exempt.

END OF SECTION 22 05 48

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.02 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: Yellow.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing

numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:
   1. Domestic Water Piping (Cold Water / Hot Water / Hot Water Return):
      a. Background Color: Green.
      b. Letter Color: White.
   2. Sanitary Waste Piping:
      a. Background Color: Blue
      b. Letter Color: White

END OF SECTION 22 05 53

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic cold, hot-water and hot-water recirculation piping.
   2. Supplies and drains for handicap-accessible lavatories and sinks.
   3. Sanitary waste piping exposed to freezing conditions.
   4. Storm-water piping exposed to freezing conditions and horizontal piping within building.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Glass-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000-Degree Pipe Insulation.
c. Manson Insulation Inc.; Alley-K.
d. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Glass-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Division 01 Section "Product Requirements."
a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Glass-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.05 SEALANTS

A. Joint Sealants:
1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.07 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.08 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, [1/2 inch (13 mm)] [3/4 inch (19 mm)] wide with closed seal.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ITW Insulation Systems; Gerrard Strapping and Seals.

b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to

structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches (50 mm)] [4 inches (100 mm)] o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to

and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF GLASS-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

3.06 FINISHES

A. Do not field paint aluminum or stainless-steel jackets.

3.07 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Underground piping.
   2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.08 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold, Hot Water and Hot Water Return: Insulation shall be the following:
   1. Glass-Fiber, Preformed Pipe Insulation, Type I: ½ thickness for runouts, 1" thick for pipe sizes up to 2", and 1-1/2" thick for pipe sizes greater than 2".

END OF SECTION 22 07 19

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other marking of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Copper Pressure-Seal-Joint Fittings:
1. 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:
a. NIBCO Inc.
b. Viega.
2. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

3. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.03 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

2.04 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

2.05 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

2.06 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material Body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
1. Description:
a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Description:
a. Factory-fabricated, bolted, companion-flange assembly.
b. Pressure Rating: 150 psig (1035 kPa).
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric Nipples:
1. Description:
a. Electroplated steel nipple.
b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).

c. End Connections: Male threaded or grooved.
d. Lining: Inert and noncorrosive, propylene.

2.07 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve immediately upstream of each dielectric fitting.

D. Install domestic water piping level and plumb.

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping adjacent to equipment and specialties to allow service and maintenance.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

3.03 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
   2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

3.04 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
   1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
   2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

3.05 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

3.06 FLEXIBLE CONNECTOR INSTALLATION

A. Install bronze-hose flexible connectors in copper domestic water tubing.

B. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.07 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   3. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 Feet (3m) with 1/2-inch (13-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.08 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.09 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:
        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 4 (DN 100) and smaller, shall be the following:
1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) wrought- copper solder-joint fittings; and soldered joints or copper pressure-seal-joint fittings; and pressure-sealed joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 (DN 100), shall be the following:
1. Soft copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings.

E. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use ball or gate valves for piping NPS 3 (DN 65) and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 4 (DN 100).
2. Drain Duty: Hose-end drain valves.

END OF SECTION 22 11 16

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaaskets: ASTM C 564, rubber.

2.03 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ANACO-Husky.
      b. Clamp-All Corp.
      c. Dallas Specialty & Mfg. Co.
      d. MIFAB, Inc.

e. Mission Rubber Company; a division of MCP Industries, Inc.
f. Stant.
g. Tyler Pipe.

2. Standards: ASTM C 1277 and ASTM C 1540.

2.04 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Dallas Specialty & Mfg. Co.
      2) Fernco Inc.
      3) Mission Rubber Company; a division of MCP Industries, Inc.
      4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
   b. Standard: ASTM C 1173.
   c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. Sleeve Materials:
      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cascade Waterworks Mfg. Co.
      2) Mission Rubber Company; a division of MCP Industries, Inc.
   b. Standard: ASTM C 1460.
   c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and

calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.02 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.03 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in OD's.
   2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.04 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.
   1. Horizontal Piping: Horizontal backwater valves.
   2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
   3. Install backwater valves in accessible locations.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   3. Vertical Piping: MSS Type 8 or Type 42, clamps.
   4. Install individual, straight, horizontal piping runs:
      a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.

b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 (DN 150): 60 inches (1500mm) with 3/4-inch (19-mm) rod.
5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

5. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
   1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.07 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 6 and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

C. Aboveground, vent piping NPS 4 and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

D. Underground, soil, waste, and vent piping NPS 8 and smaller shall be the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.

END OF SECTION 22 13 16

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Miscellaneous sanitary drainage piping specialties.
6. Flashing materials.
7. Grease interceptors.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.03 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.01 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:
1. 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:
a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.

4. Body: Cast iron.
5. Cover: Cast iron with [bolted] access check valve.
6. End Connections: [Hub and spigot].
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang [closed].
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:
1. 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]:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

2.02 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:
1. 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:
   a. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe.
   e. Watts Drainage Products.
   f. Zurn Plumbing Products Group.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. 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:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Tyler Pipe; Wade Div.
   d. Watts Drainage Products Inc.
   e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for adjustable housing, cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Inside calk.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with threads or set-screws or other device.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:
1. 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:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee] as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round nickel-bronze or stainless-steel wall-installation frame and cover.

2.03 FLOOR DRAINS

A. Cast-Iron Floor Drains:
   1. 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:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Standard: ASME A112.6.3.
   3. Pattern: Floor drain.
   4. Body Material: Gray iron.
   5. Seepage Flange: Required.
   6. Anchor Flange: Required.
   7. Clamping Device: Required.
   8. Outlet: Bottom.
   9. Backwater Valve: Not required.
   10. Coating on Interior and Exposed Exterior Surfaces: Not required.
   11. Sediment Bucket: Not required.
   12. Top or Strainer Material: Nickel bronze.
   13. Top of Body and Strainer Finish: Nickel bronze.
   14. Top Shape: Round.
   15. Top Loading Classification: Heavy Duty.
   16. Funnel: Not required.
   17. Inlet Fitting: Not required.
   18. Trap Material: Cast iron.
   19. Trap Pattern: Deep-seal P-trap.
   20. Trap Features: Cleanout

2.04 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:
   1. 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:
      a. Acorn Engineering Company; Elmdor/Stoneman Div.
      b. Thaler Metal Industries Ltd.
   2. Description: Manufactured assembly made of [4.0-lb/sq. ft., 0.0625-inch-] thick, lead flashing collar and skirt extending at least [8 inches] from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:
   1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
   2. Size: Same as connected waste piping or with increaser fitting of size indicated.

B. Deep-Seal Traps:
   1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   2. Size: Same as connected waste piping.
      a. NPS 2: 4-inch- minimum water seal.
      b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:
   1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch] above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
   2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:
   1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
   2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

2.06 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
   2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Assemble open drain fittings and install with top of hub 1 inch above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.04 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.05 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

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PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Sleeve-seal systems.
   3. Grout.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.02 SLEEVE-SEAL SYSTEMS

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. Advance Products & Systems, Inc.
   2. Metraflex Company (The).
   3. Pipeline Seal and Insulator, Inc.
   4. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above Grade:
      a. Piping Smaller Than NPS 6: Cast-iron wall sleeves or Galvanized-steel-pipe sleeves.
      b. Piping NPS 6 and Larger: Cast-iron wall sleeves or Galvanized-steel-pipe sleeves.
   2. Exterior Concrete Walls below Grade:
      a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
      b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs-on-Grade:
      a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
      b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   4. Concrete Slabs above Grade:
      a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
      b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
   5. Interior Partitions:
      a. Verify, with fire authorities having jurisdiction, that PVC materials are allowed for sleeves.

b. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
c. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Escutcheons.
   2. Floor plates.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install **escutcheons** for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
      c. Insulated Piping: One-piece, stamped-steel type.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.

e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping: One-piece, floor-plate type.

3.02 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 23 05 18

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Equipment supports.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Welding certificates.

1.04 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2] and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
      b. NPS 4: 12 inches long and 0.06 inch thick.

4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to [1-1/2 inches].

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
   3. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
   4. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb (340 kg).
   b. Medium (MSS Type 32): 1500 lb (680 kg).
   c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

END OF SECTION 23 05 29

PART 1 - GENERAL

1.01 DESCRIPTION

A. Intent
1. All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
2. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
3. It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.
4. All such systems must be installed in strict accordance with seismic codes, component manufacturer=s and building construction standards. Whenever a conflict occurs between the manufacturer=s or construction standards, the most stringent shall apply.
5. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
6. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.
7. Seismic restraints shall be designed in accordance with seismic force levels as detailed in section 1.0.6.

B. The work in this section includes, but is not limited to the following:
1. Vibration isolation for piping, ductwork and equipment.
2. Equipment isolation bases.
3. Flexible piping connections.
4. Seismic restraints for isolated equipment.
5. Seismic restraints for non-isolated equipment.
6. Certification of seismic restraint designs and installation supervision.
7. Certification of seismic attachment of housekeeping pads.
8. All mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification).

AC Units	Chillers	Fans (All types)	Tanks (All types)
Air Distrib. Boxes	Compressors	Generators	Transformers
Air Handling Units	Comp. Room Units	Heat Exchangers	Unit Heaters

Air Separators	Condensers	Light Fixtures*	Unit Subastion
Battery Racks*	Condensing Units	Motor ControlCtrs.	*Var. Freq.
Boilers	Conduit*	Piping	Drives*
Bus Ducts*	Cooling Towers	Pumps(all types)	Water Heater
Cabinets Heaters	Ductwork	Rooftop Units	
Cable Trays*	Electrical Panels	Switch Gerar*	

*Solid Bracing Only

C. Definitions
   1. Life Safety Systems:
      a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
      b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers and all flowpaths to fire protection and/or emergency lighting systems.
      c. All medical and life support systems.
      d. Fresh air relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.
      e. All life safety equipment has an asterisk on the equipment schedule.
   2. Positive Attachment:
      A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided AC@ type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, or any other equipment are not acceptable on this project as seismic attachment.
      a. points.
   3. Transverse Bracing:
      a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
   4. Longitudinal Bracing:
      a. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

1.02 SUBMITTAL DATA REQUIREMENTS

A. The manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:
   1. Descriptive Data:
      a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
      b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.
   2. Shop Drawings:
      a. Submit fabrication details for equipment bases including dimensions,

structural member sizes and support point locations.

b. Provide all details of suspension and support for ceiling suspended equipment.

c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers= submittals must include spacing, static loads and seismic loads at all attachment and support points.

d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.

3. Seismic Certification and Analysis:

a. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.

b. All restraining devices shall have a preapproval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Preapprovals based on independent testing are preferred to preapprovals based on calculations. Where preapproved devices are not available, submittals based on independent testing are preferred. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45E to the weakest mode.

c. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces detailed in section 1.06 acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

1.03 CODE AND STANDARDS REQUIREMENTS

A. Typical Applicable codes and Standards

1. The international building code, IBC – 2012 as published by the international code council.

2. The Arkansas Mechanical code, 2021

1.04 MANUFACTURER'S RESPONSIBILITY

A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:

1. Determine vibration isolation and seismic restraint sizes and locations.
2. Provide vibration isolation and seismic restraints as scheduled or specified.
3. Provide calculations and materials if required for restraint of unisolated equipment.
4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.05 RELATED WORK

A. Housekeeping Pads
   1. Housekeeping pad reinforcement and monolithic pad attachment to the structure details and design shall be prepared by the restraint vendor if not already indicated on the drawings.
   2. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

B. Supplementary Support Steel
   1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.

C. Attachments
   1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.06 SEISMIC FORCE LEVELS

A. The following force levels will be used on this project.

MINIMUM F_p (G=s) FORCES EQUAL TO OR EXCEEDING BUILDING CODE LIST IN 1.03.

IBC-2000 TI-809-04 / IBC-2003 NFPA-5000	"G" Forces for High Deformability Pipe, Bus Ducts, Conduits & Cabletrays a_p*=1.0, R_p*=3.5	"G" Forces for Rigidly Mounted Equipment & Limited Deformability Pipe a_p*=1.0, R_p*=2.5	"G" Forces for Vibration Isolated Equipment & Pipe Pressure Vessels a_p*=2.5, R_p*=2.5	"G" Forces for Low Deformability Pipe a_p*=1.0, R_p*=1.25
Ss = 1.56	Horiz. Vert.	Horiz. Vert.	Horiz. Vert.	Horiz. Vert.

Lower Levels and Ground Level.	0.50	0.33	0.50	0.33	0.67	0.33	0.53	0.33
Above Ground Level up to 1/4 of the Height of the Building.	0.50	0.33	0.50	0.33	1.00	0.33	0.80	0.33
Above ¼ up to ½ of the Height of the Building.	0.50	0.33	0.53	0.33	1.34	0.33	1.07	0.33
Above 1/2 up to 3/4 of the Height of the Building.	0.50	0.33	0.67	0.33	1.67	0.33	1.34	0.33
Above ¾ of Height of Building up to the Roof	0.57	0.33	0.80	0.33	2.00	0.33	1.60	0.33

*See definitions on page 1, SVCS-110, Part 1.

See instructions on page 5, SVCS-110, Part 1. Add data as required for a particular project. Use only one code per project and add the data on the appropriate line. Codes that are not applicable should be omitted to avoid confusion.

Table 1.06-1

PART 2 - PRODUCTS

2.01 INTENT

A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. Mason Industries' products are the basis of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with the specification and have the approval of the specifying engineer. Submittals and certification sheets shall be in accordance with section 1.02.

B. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8" (3mm) and/or horizontal permanent deformation greater that ¼" (6mm).

2.02 PRODUCT DESCRIPTIONS

A. Vibration Isolators and Seismic Restraints.

SPECIFICATION:

1. Two layers of 3/4" (19mm) thick neoprene pad consisting of 2" (50mm) square

waffle modules separated horizontally by a 16 (1.5mm) gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be type Super W as manufactured by Mason Industries, Inc.

2. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" (5mm) and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Preapproval "R"Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be type BR as manufactured by Mason Industries, Inc.
3. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be type PB as manufactured by Mason Industries, Inc.
4. A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be type HG as manufactured by Mason Industries, Inc.
5. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" (6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be type SLF as manufactured by Mason Industries, Inc.
6. Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Restraining Bolts shall have a neoprene bushing between the bolt and the housing. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad.Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Preapproval "R " Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings. Mountings shall be type SLR or

SLRS as manufactured by Mason Industries, Inc.

7. Spring mountings as in specification 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4" (6mm) travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Preapproval “R” number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be type SSLFH as manufactured by Mason Industries, Inc.
8. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8" (3mm). Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be type MT and leveling valves type LV as manufactured by Mason Industries, Inc.
9. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" (12mm) shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be type SLR-MT as manufactured by Mason Industries, Inc.
10. Hangers shall consist of rigid steel frames containing minimum 1 1/4" (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30deg. arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30 deg. capability. Hangers shall be type 30N as manufactured by Mason Industries, Inc.

10A. Hangers shall be as described in 10, but they shall be supplied with a combination rubber and steel rebound washer as the seismic upstop for suspended piping, ductwork, equipment and electrical cabletrays. Rubber thickness shall be a minimum of 1/4" (6mm). Submittals shall include a drawing of the hanger showing the installation of the rebound washer. Hangers shall be type RW30N as manufactured by Mason Industries, Inc.

11. Hangers shall be as described in 10, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed

with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30 deg. capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc.

12. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables must be prestretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.
13. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified load ratings. Solid seismic brace assemblies shall be type SSB, SSBS or SSRF as manufactured by Mason Industries, Inc.

    Note: Specifications 12 - 14 apply to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze. Specifications apply to hanging equipment as well.
14. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Rod clamp assemblies shall be type SRC or UC as manufactured by Mason Industries, Inc.
15. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.
16. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4" (6mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm^2). A minimum air gap of 1/8" (3mm) shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall have an Anchorage Preapproval "R" Number from OSHPD in the State of California

verifying the maximum certified horizontal and vertical load ratings. Snubber shall be type Z-1225 as manufactured by Mason Industries, Inc.

17. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" (19mm) thick. Rated loadings shall not exceed 1000 psi (.7kg/mm^2). Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" (3mm) nor more that 1/4"(6mm). Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8" (9mm) deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable" G" force. Submittals shall include the load deflection curves up to 1/2" (12mm) deflection in the x, y and z planes. Snubbers shall have an anchorage preapproval "R" number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be type Z-1011 as manufactured by Mason Industries, Inc.
18. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is Arolled up@ to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be type SAS as manufactured by Mason Industries, Inc.
19. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be type SAB as manufactured by Mason Industries, Inc.
20. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14" (350mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1" (25mm). Bases shall be type WF as manufactured by Mason Industries, Inc.
21. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6" (150mm). The base depth need not exceed 12" (300mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" (12mm) bars welded in place on 6" (150mm) centers running both ways in a layer 1 2" (38mm) above the bottom.

Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" (25mm) clearance below the base. Wooden formed bases leaving a concrete rather then a steel finish are not acceptable. Base shall be type BMK or K as manufactured by Mason Industries, Inc.

22. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal or structural steel sections containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4" (6mm) thick. Steel springs shall be laterally stable and rest on 1/4" (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous flexible flashing nailed over the lower curbs waterproofing. All spring locations shall have accessibility to adjust springs. Lower curbs shall have provision for 2" (50mm) of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit must be solidly fastened to the top floating rail, and the lower section anchored to the roof structure. Curb shall have anchorage pre-approval “R” from OSHPD in the state of California attesting to the maximum certified horizontal and vertical load ratings. Curb shall be type SRSC or RMSS as manufactured by Mason Industries, Inc.

22A. Curb mounted rooftop equipment shall be mounted on top of Rigid Seismic Roof curbs. Curb sections shall be designed by an engineer licensed in the state where the project is, and shall be either structural steel channels or 12-gauge sheet metal. Field assembled joints are to include a minimum of 2 rows of 3 bolts at each connection. Curb to have a factory installed wood nailer. The Rooftop unit must be fastened to the curb and the curb fastened to the structure to resist both seismic and wind forces. Submittal shall include calculations by a professional engineer licensed in the state, and the engineer shall have a minimum of 5 years experience in seismic applications. Curb details and unit connection to curb details shall be included. Mounting hardware for unit to curb attachment will be provided by the installing contractor. Curbs shall be type RRC as manufactured by Mason Industries, Inc. Curb shall match slope of the supporting structure.

23. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar7 tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" (50mm) and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16"(400mm) to 24" (600mm) may be single sphere. Sizes :@ (19mm) to 12@ (38mm) may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi up to 170deg.F with a uniform drop in allowable pressure to 215 psi at 250deg F in sizes through 14" (350mm). 16" (400mm) through 24" (600mm) single sphere minimum ratings are 180 psi at

170deg F and 150 psi at 250deg. F . Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.

Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. If control rods are used, they must have ½" (12mm) thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi (.7 kg/mm^2) maximum on the washer area.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be type SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

24. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" (75mm) and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

Flanged

3" x 14" (75 x 350mm)	6" x 20" (150 x 500mm)	12" x 28" (300 x 700mm)
4" x 15" (100 x 375mm)	8" x 22" (200 x 550mm)	14" x 30" (350x750mm)
5" x 19" (125 x 475mm)	10" x 26" (250 x 650mm)	16" x 32" (400 x 800mm)

Male Nipples

1/2" x 9" (12 x 225mm)	1 1/4" x 12" (32 x 300mm)	2" x 14" (50 x 350mm)
3/4" x 10" (19 x 250mm)	1 1/2" x 13" (38 x 325mm)	2 1/2" x 18" (64x 450mm)
1" x 11" (25 x 275mm)		

Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS as manufactured by Mason Industries, Inc.

25. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" (12mm) thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi (.35 kg/mm^2) and the design shall be balanced for equal resistance in any

direction. All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.

26. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" (12mm) thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of +/- 5/8" (41mm) motion, or to meet location requirements. Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.
27. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" (19mm) thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" (25mm) past either face of the wall. Where temperatures exceed 240deg. F, 10# (4.5kg) density fiberglass may be used in lieu of the sponge. Seals shall be type SWS as manufactured by Mason Industries, Inc.
28. The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" (6mm) movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be type WBI/WBD as manufactured by Mason Industries, Inc.
29. Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor shall be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping pad anchors shall be attached to the structural slab using a stud wedge anchor. Housekeeping pad anchors shall be type HPA and stud wedge anchor shall be type SAS both as manufactured by Mason Industries, Inc.

PART 3 - EXECUTION

3.01 GENERAL

A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.

C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.

D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. “Building” includes, but is not limited to, slabs, beams, columns, studs and walls.

E. Coordinate work with other trades to avoid rigid contact with the building.

F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractors expense.

G. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractors expense.

H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractors expense.

I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
   1. Flanges of structural beams.
   2. Upper truss cords in bar joist construction.
   3. Cast in place inserts or wedge type drill-in concrete anchors.

J. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

K. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.

L. At locations where specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with specification 14 braces.

M. At locations where specification 12 cable restraints are installed on support rods with spring isolators, the spring isolation hangers must be specification type 10A.

N. At all locations where specification 12 or 13 restraints are attached to pipe clevis, the clevis cross bolt must be reinforced with specification type 15 braces.

O. Drill-in concrete anchors for ceiling and wall installation shall be specification type 18, and specification type 19 female wedge type for floor mounted equipment.

P. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.

Q. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification 23 capabilities.

R. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification 27 wall seals.

S. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type 28 (see selection guide).

T. Locate isolation hangers as near to the overhead support structure as possible.

U. All fire protection piping shall be braced in accordance with NFPA 13 and 14.

V. All mechanical equipment shall be vibration isolated and seismically restrained as per the schedules in part 4 of this specification.

W. All fire protection equipment is considered life safety equipment and shall be seismically restrained using the seismic force levels for life safety equipment in table 1.06-1, if higher levels are shown.

3.02 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF PIPING

A. Horizontal pipe isolation: The first four pipe hangers in the main lines near the mechanical equipment shall be as described in specification 11. Brace hanger rods with SRC clamps specification 14. Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in specification 10 & 10A. Floor supported piping shall rest on isolators as described in specification 6. Heat exchangers and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75" (19mm) deflection for pipe sizes up to and including 3" (75mm), 1 1/2" (38mm) deflection for pipe sizes up to and including 6" (150mm), and 2 1/2" (64mm) deflection thereafter. Hangers shall be located as close to the overhead structure as practical. Hanger locations that also have seismic restraints attached must have type RW Rebound Washers to limit uplift. Where piping connects to mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Riser isolation: Risers shall be suspended from specification 10A hangers or supported by specification 5 mountings, anchored with specification 25 anchors, and guided with

specification 26 sliding guides. Steel springs shall be a minimum of 0.75" (19mm) except in those expansion locations where additional deflection is required to limit load changes to +/- 25% of the initial load. Submittals must include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.

C. Seismic Restraint of Piping

1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables if isolated. Specification 12 or 13 restraints may be used on unisolated piping.
   a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping that is 1" (25mm) I.D. or larger.
   b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" (32mm) I.D. and larger.
   c. All other piping 2 1/2" (64mm) diameter and larger.
2. Transverse piping restraints shall be at 40' (12m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
3. Longitudinal restraints shall be at 80' (24m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
5. For fuel oil and all gas piping transverse restraints must be at 20' (6m) maximum and longitudinal restraints at 40' (12m) maximum spacing.
6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" (600m) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
7. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
8. Branch lines may not be used to restrain main lines.
9. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in areas with Ss of 0.35 or greater shall be braced as in sections 3.02.C.2 and 3. For areas with Ss less than 0.35, 2 band clamps may be used with a reduced spacing of 1/2 of those listed in sections 3.02.C.2 and 3.
10. Connection to the structure must be made with a non-friction connection (i.e. no AC@ clamps)
11. Hanger locations that also have seismic restraints attached must have Specification 10A type RW Rebound Washers.
12. Piping which crosses building expansion joints shall be anchored on each side of the joint. Ball joints or braided hose assemblies shall be employed to allow the specified movement of the building without affecting the integrity of the piping system.

D. Pipe Exclusions
   1. Gas piping less than 1" (25mm) inside diameter.
   2. Piping in boiler and mechanical rooms less than 1 1/4" (32mm) inside diameter.
   3. All other piping less than 2 1/2" (64mm) inside diameter.
   4. a. All piping suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12" or less.
      b. All trapezed piping where the distance from the suspension point to the trapeze member is 12" or less.
      c. If any suspension location in the run exceeds the above, the entire run must be braced.

3.03 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF DUCTWORK

A. Vibration isolation of ductwork
   1. All discharge runs for a distance of 50' (15m) from the connected equipment shall be isolated from the building structure by means of specification 10 hangers or specification 5 floor isolators. Spring deflection shall be a minimum of 0.75" (19mm).
   2. All duct runs having air velocity of 1000 fpm (5 m/s)or more shall be isolated from the building structure by specification 11 hangers or 5 floor supports. Spring deflection shall be a minimum of 0.75" (19mm).

B. Seismic restraint of ductwork

   1. Seismically restrain all ductwork with specification 12 or 13 restraints as listed below:
      a. Restrain rectangular ducts with cross sectional area of 6 sq.ft. (.5 m^2) or larger.
      b. Restrain round ducts with diameters of 28" (700mm) or larger.
      c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
   2. Transverse restraints shall occur at 30' (9mm) intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
   3. Longitudinal restraints shall occur at 60' (18m) intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
   4. The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
   5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.

6. Walls, including gypsum board non bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
7. Connection to the structure must be made with a non-friction connection (i.e. no "C" clamps)
8. Hanger locations that also have seismic restraints attached must have Specification 10A type RW Rebound Washers.

C. Ductwork Exclusions
1. Rectangular and square and ducts that are less than 6 square feet in cross sectional area.
2. Oval ducts that are less than 6 square feet (.5m^2) in cross sectional area based on nominal size.
3. Round duct less than 28" (.5m^2) in diameter.
4. a. All trapezed ductwork where the distance from the suspension point to the trapeze member is 12" or less.
   b. Ductwork hung with straps where the top of the duct is 12" or less from the suspension point and the strap has 2 #10 sheet metal screws within 2" of the top of the duct.
   c. If any suspension location in the run exceeds the above, the entire run must be braced.

3.04 ELECTRICAL SERVICES

A. Seismic Restraint
1. All electrical conduit 2 1/2" (64mm) in diameter and larger shall be restrained with specification type 12 seismic cable restraints or specification type 13 for seismic solid brace restraints.
2. All electrical bus ducts, cable trays and ladder trays shall be restrained with specification type 12, seismic cable restraints or specification 13 seismic solid brace restraints.
3. Transverse restraints shall occur at 30' (9m) intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.
4. Longitudinal restraints shall occur at 60' (18m) intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4' (1.2m) of the intersection of the electric run and if the restraints are sized for the larger electric run.
5. All floor mounted transformers, motor starters, switchgears and substations must have a resilient media between the equipment mounting hole and the anchor bolt. Anchor bolts shall be designed in accordance with section 1.06 seismic forces. Neoprene bushings shall be specification type 4 and anchor bolts shall be specification type 18 or 19.
6. Wall mounted panels, transformers and motor starters shall be mounted with specification type 3 bushings. Floor mounted panels shall be mounted on specification type 4 bushings. Anchor bolts shall be specification type 18 or 19.

7. All generators shall be mounted on a Specification type 21 concrete inertia base, with Specification type 5 spring isolators and Specification type 17 seismic snubbers.
8. Connection to the structure must be made with a non-friction connection (i.e. no "C" clamps)

B. Exclusions
1. All conduit less than 2 1/2" (64mm) diameter suspended by individual hanger rods.
2. a. All conduits suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12" or less.
b. All trapezed conduits, bus ducts and cable trays where the distance from the suspension point to the trapeze member is 12" or less.
c. If any suspension location in the run exceeds the above, the entire run must be braced.

PART 4 - SCHEDULES

4.01 EQUIPMENT ISOLATOR AND SEISMIC RESTRAINT SCHEDULE

	Vibration Isolation and/or Seismic Restraint	
Equipment Schedule	Specification *	Static Deflection *
HRU-1	4, 19	0
HRU-DI, D2 AND D3	4, 19	0
FC-1 THRU 9	10, 12, 14	1"
BS-1 THRU 7	10, 12, 14	1"
DOAS-1	10, 12, 14	1"
DOAS-2 AND 3	4, 19, 29	0
EF-1 THRU 5	10, 12, 14	1"
EH-1 THRU 4	3	0
DSS-1	3	0
DHP-1	4, 19	0

*If static deflection isn't listed, then the product does not require resilient mounts, or spring hangers.

*Where no specification numbers are listed, or where equipment is attached to mounting bases, curbs or rails, the equipment identified still is required to be restrained. Mason Industries will provide engineering calculation, and details. Mounting hardware will be provided by others.

4.02 EXCLUSIONS:

A. Equipment connected to the duct system shall be restrained if the equipment weighs more than 50 lbs. Equipment weighing more than 20 lbs., and is connected flexibly to the ductwork, shall be seismically restrained. Any equipment weighing less than 20 lbs. is exempt.

END OF SECTION 23 05 48

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.

1.02 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   4. Fasteners: Stainless-steel [rivets or self-tapping screws.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.03 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Pipe Label Color Schedule:
   1. Refrigerant Piping:
      a. Background Color: Yellow.
      b. Letter Color: Black.
   2. Condensate Drain Piping:
      a. Background Color: Yellow.
      b. Letter Color: Black.

END OF SECTION 23 05 53

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
      b. Variable-air-volume systems.

1.02 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An entity engaged to perform TAB Work.

1.03 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

1.04 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
   1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
   2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Automatic temperature-control systems are operational.
   3. Equipment and duct access doors are securely closed.
   4. Balance, smoke, and fire dampers are open.
   5. Isolating and balancing valves are open and control valves are operational.
   6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
   1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
   2. Measure fan static pressures as follows to determine actual static pressure:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
      d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
   3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
   1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
   2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
   3. Measure total system airflow. Adjust to within indicated airflow.
   4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
   5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
      a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
   6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
      a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
   7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
   8. Record final fan-performance data.

3.07 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.08 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:
   1. Nameplate data.
   2. Airflow.
   3. Entering- and leaving-air temperature at full load.
   4. Voltage and amperage input of each phase at full load and at each incremental stage.
   5. Calculated kilowatt at full load.
   6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:
   1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.09 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.

3.10 REPORTING

A. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.
   4. Field test reports prepared by system and equipment installers.
   5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB contractor.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of TAB supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, concealed return located in unconditioned space.
   3. Outdoor, concealed supply and return.
   4. Outdoor, exposed supply and return.

B. Related Sections:
   1. Section 230716 "HVAC Equipment Insulation."
   2. Section 230719 "HVAC Piping Insulation."
   3. Section 233113 "Metal Ducts" for duct liners.

1.02 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-

applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.

4. Color: White.

2.04 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg. F.
   4. Color: Aluminum.
   5. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.05 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.06 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   1. Finish and thickness are indicated in field-applied jacket schedules.
   2. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper 2.5-mil- thick polysurlyn.

2.07 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 6.5 mils
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
   1. Width: 2 inches.
   2. Thickness: 3.7 mils.
   3. Adhesion: 100 ounces force/inch in width.

4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.08 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with closed seal.

B. Insulation Pins and Hangers:
1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Aluminum fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
   b. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
   c. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, [galvanized-steel] [aluminum] [stainless-steel] sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 incheso.c.
    a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.
      f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied

in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.05 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.07 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return air.

B. Items Not Insulated:
1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Exhaust Ducts.

3.08 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Round, Flat-Oval and Rectangular Supply-Air Duct Insulation: Mineral-fiber blanket 2 inches thick and 0.75-lb/cu. ft. nominal density.

B. Concealed, Round, Flat-Oval and Rectangular Return-Air Duct Insulation: Mineral-fiber blanket 2 inches thick and 0.75-lb/cu. ft. nominal density.

C. Concealed, Round, Flat-Oval and Rectangular Outdoor-Air Duct Insulation: Mineral-fiber blanket 2 inches thick and 0.75-lb/cu. ft. nominal density.

END OF SECTION 23 07 13

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Refrigerant suction and hot-gas piping, indoors and outdoors.
   2. Condensate drain piping, indoors and outdoors.

B. Related Sections:
   1. Section 230713 "Duct Insulation."
   2. Section 230716 "HVAC Equipment Insulation."

1.02 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

E. Mineral-Fiber, Preformed Pipe Insulation:
   1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
   1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
   1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
   1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
   3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
   1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
   3. Solids Content: 60 percent by volume and 66 percent by weight.
   4. Color: White.

2.05 SEALANTS

A. Joint Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Permanently flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
   4. Color: White or gray.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
   4. Color: White.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.07 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   1. Finish and thickness are indicated in field-applied jacket schedules.
   2. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.

2.08 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches (75 mm).
   2. Thickness: 11.5 mils (0.29 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.09 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) [4 inches (100 mm)] o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Where pipe expansion is anticipated, detail expansion compensation for insulation on Drawings and indicate intervals for its occurrence. See the Midwest Insulation Contractors Association's "National Commercial & Industrial Insulation Standards," Plate No. 41A.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.08 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.09 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping Insulation shall be the following:
   1. Flexible elastomeric 1 inch (25 mm) thick.

B. Condensate Drain Piping:
   1. Mineral-Fiber, preformed pipe, type 1 1/2 inch (12mm) thick..

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be one of the following:
   1. Flexible Elastomeric: 2 inches (50 mm) thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:
   1. Aluminum, Smooth 0.020 inch (0.51 mm) thick.

END OF SECTION 23 07 19

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building Automation System (BAS), utilizing Direct Digital Controls as described herein. All controllers furnished in this section shall communicate on a peer-to-peer bus over the BACnet protocol.

1. System architecture shall provide secure Web-based access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
2. The BAS network controller shall host all graphic files for the control system.
3. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BAS.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. KMC Controls by Harrison Energy Partners

B. Johnson Controls Facility Explorer by Harrison Energy Partners

C. Substitutions: Engineer Approved Equal

2.02 GENERAL

A. The Building Automation System (BAS) shall be comprised of a network of interoperable, stand-alone digital controllers, a network area controller, graphics and programming and other control devices for a complete system as specified herein.

B. The Building Automation System (BAS) shall be Niagara N4 and shall be installed at the latest possible revision level.

2.03 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing open protocols in one open, interoperable system.

B. The supplied system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins.

2.04 BAS SYSTEM WEB BROWSER GUI - SYSTEM OVERVIEW

A. The BAS Contractor shall provide system software based on thin-client architecture, designed around the open standards of web technology. BAS shall be accessed using a web browser over Owner intranet and remotely over the Internet.

B. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
   1. Real time 'live' Graphic Programs.
   2. Trending.
   3. Scheduling.
   4. Parameter change of properties.
   5. Set point adjustments.
   6. Consolidated system reports
   7. Alarm / event information.
   8. Configuration of operators.
   9. Execution of global commands.

PART 3 - EXECUTION

3.01 GENERAL

A. Install system and materials in accordance with manufacturer's instructions and as detailed on the project drawing set.

B. Low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.

C. Equipment furnished by the Mechanical Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.

D. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.02 WIRING

A. All low voltage electrical control wiring to the control panels shall be the responsibility of the Control System Contractor unless noted otherwise on plans.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes.

C. Use manufacturer-specified wire for all network connections.

D. Wiring installed outside or exposed is to be installed in EMT conduit.

E. Wiring above accessible ceiling can be installed without raceway. Wiring should be installed neatly and suspended with j-hooks.

3.03 OPERATOR TRAINING

A. The Control System Contractor shall provide one day of comprehensive training for the

Owner's representative to enable proficient operation of the system. Training shall be provided after final commissioning of the project.

3.04 WARRANTY PERIOD SERVICES

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance. Within this period, upon notice by the Owner, any defects in the BAS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

END OF SECTION 23 09 00

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
   1. Chilled-water piping.
   2. Condensate-drain piping.

1.02 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
   1. Condensate-Drain Piping 150 deg. F.

1.03 SUBMITTALS

A. Product Data: For each type of the following:
   1. Hydronic specialties.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: [ASTM B 88, Type L].

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   3. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings designation or a comparable product by one of the following:
      a. Anvil International, Inc.
      b. S. P. Fittings; a division of Star Pipe Products.

E. Copper Pressure-Seal Fittings
   1. 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:
      a. NIBCO INC.
      b. Viega.
   2. Housing: Copper
   3. O-Rings and Pipe Stops: EPDM.
   4. Tools: Manufacturer's special tools.
   5. Minimum 200-psig (1379-kPa) working-pressure rating at 250 deg F (121 deg C).

F. Wrought-Copper Unions: ASME B16.22.

2.02 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.03 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. 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:
      a. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      b. Wilkins; a Zurn company.
   2. Description:
      a. Standard: ASSE 1079.
      b. Pressure Rating: 150 psig.
      c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Condensate – Drain Piping: Type M Drawn-Tempered Copper Tubing, Wrought-Cooper Fittings, and Soldered Joints or Pressure Seal Joints.

3.02 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

R. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."

3.03 HANGERS AND SUPPORTS

A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
   6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
   2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
   3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.

5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. NPS 4 and Larger: Maximum span, 14 feet; minimum rod size, 1/2 inch.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.

3.04 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

3.05 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

3.06 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

END OF SECTION 23 21 13

PART 1 - GENERAL

1.01 HVC piping systems shall consist of refrigerant piping handling fluorocarbons.

1.02 Do not vent refrigerants to the atmosphere. Install new systems using recovering methods. Evacuate and recover existing systems to be modified or removed.

1.03 Submit piping materials, fittings, and refrigeration accessories

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING:

A. Pipe: "K" copper. Soft-drawn may be used where bending is required on 1-3/8" O.D. and smaller. All other shall be hard-drawn; or Type "L" Copper, hard-drawn, marked "ACR" at Contractor's Option.

B. Fittings: Wrought copper or forged brass for refrigerant use.

PART 3 - EXECUTION

3.01 REFRIGERANT PIPING:

A. To be installed by machine mechanics skilled in this type work, and in accordance with recognized industry standards.

B. Make joints with "Sil-Fos" backed with nitrogen.

C. Piping and specialties to be sized and installed as recommended by the manufacturer of refrigerant piping.

D. Pre-charged lines may be used with approval of Engineer. These lines shall be installed as recommended by the unit manufacturer. Check charge after installation.

E. See Section 23 07 19 for insulation.

F. Isolate piping from building structure to prevent transmitting equipment vibration.

G. See Section 23 05 29 for hangers.

I. Installation:
   1. Minimum Requirements: Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and

connections to compressors, condensers, evaporators and other equipment tightly capped until assembly. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

2. Testing:
   a. General: Every refrigerant containing part of every system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high or low side of the system, respectively.
   b. Test Medium: Oxygen, or any combustible gas, or combustible mixture of gases shall not be used within the system for testing. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-relief device, and a gage on the outlet side. Set the pressure-relief device above the test pressure but low enough to prevent permanent deformation of the system components.
   c. System Test And Charging: Recommended by the equipment manufacturer or as follows:
      1) Connect source or refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 10 psig. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
      2) Connect a source of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Refer to Table For Test Pressures. Test entire system again for leaks.
      3) Operating Pressures, PSIG: From ANSI B9.1.

Refrigerant	Low Side	High Side
R-407C	150	230

      4) Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gage reading in microns. Pull the system down to 100 microns and hold for four hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

END OF SECTION 23 23 00

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.
6. Duct liner insulation.

B. Related Sections:
1. Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Factory- and shop-fabricated ducts and fittings.
2. Fittings.
3. Penetrations through fire-rated and other partitions.

C. Welding certificates.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
   3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. 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:
   a. McGill AirFlow LLC.
   b. SEMCO Incorporated.
   c. Sheet Metal Connectors, Inc.
   d. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches

2.04 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:
   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   2. Tape Width:[3 inches 976mm)].
   3. Sealant: Modified styrene acrylic.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   7. Service: Indoor and outdoor.
   8. Service Temperature: Minus 40 to plus 200 deg F.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
   10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. VOC: Maximum 75 g/L (less water).
   7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   8. Service: Indoor or outdoor.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," , "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
   3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
   4. Unconditioned Space, Exhaust Ducts: Seal Class C.
   5. Unconditioned Space, Return-Air Ducts: Seal Class B.
   6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
   7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
   8. Conditioned Space, Exhaust Ducts: Seal Class B.
   9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:

      a. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa): or Higher. Test
      representative duct sections totaling no less than 30 percent total installed duct area for each designated pressure class.
      b. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 30 percent total installed duct area for each designated pressure class.
   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Test for leaks before applying external insulation.
   5. Conduct tests at static pressures equal to maximum design pressure of system or sections being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   6. Give seven days' advance notice for testing.

3.07 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.08 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, and Terminal Units:
      a. Pressure Class: Positive 2-inch wg.
      b. Minimum SMACNA Seal Class: C.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.
   2. Ducts Connected to Constant-Volume Air-Handling Units:
      a. Pressure Class: Positive 3-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.
   3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
      a. Pressure Class: 4-inch wg.
      b. Minimum SMACNA Seal Class: A.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Return Ducts:
   1. Ducts Connected to Fan Coil Units, and Terminal Units:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.
   2. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.

D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 1-inch wg (250 Pa).
      b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 6.
      d. SMACNA Leakage Class for Round and Flat Oval: 3.

E. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel.
   2. Stainless-Steel Ducts:
      a. Exposed to Airstream: Match duct material.
      b. Not Exposed to Airstream: Match duct material.
   3. Aluminum Ducts: Aluminum.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    a. Velocity 1000 fpm or Lower:
        1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
        2) Mitered Type RE 4 without vanes.
    b. Velocity 1000 to 1500 fpm:
        1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
    c. Velocity 1500 fpm or Higher:
        1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
        2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
        1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
        3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
        4) Radius-to Diameter Ratio: 1.5.
    b. Round Elbows, [12 Inches] and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, [14 Inches] and Larger in Diameter: Standing seam.

G. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Spin in.
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire/smoke dampers
7. Flange connectors.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
a. Special fittings.
b. Manual volume damper installations.
c. Control damper installations.
d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
e. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: [G60].
   2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

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. Air Balance Inc.; a division of Mestek, Inc.
   2. American Warming and Ventilating; a division of Mestek, Inc.
   3. Cesco Products; a division of Mestek, Inc.
   4. Duro Dyne Inc.
   5. Greenheck Fan Corporation.
   6. NCA Manufacturing, Inc.
   7. Ruskin Company.
   8. SEMCO Incorporated.
   9. Vent Products Company, Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity 3000 fpm

D. Maximum System Pressure: 1-inch wg.

E. Frame: 0.052-inch- thick, galvanized sheet steel.

F. Blades: Multiple single-piece blades, pivoted, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl, mechanically locked.

I. Blade Axles:
   1. Material: Galvanized steel.
   2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:
   1. Adjustment device to permit setting for varying differential static pressure.
   2. Counterweights and spring-assist kits for vertical airflow installations.
   3. Electric actuators.
   4. Screen Mounting: Front mounted in sleeve.
      a. Sleeve Thickness: 20-gage minimum.
      b. Sleeve Length: 6 inches minimum.
   5. 90-degree stops.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. 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:
      a. Air Balance Inc.; a division of Mestek, Inc.
      b. American Warming and Ventilating; a division of Mestek, Inc.
      c. Flexmaster U.S.A., Inc.
      d. McGill AirFlow LLC.
      e. METALAIRE, Inc.
      f. Ruskin Company.
      g. Trox USA Inc.
   2. Standard leakage rating.
   3. Suitable for horizontal or vertical applications.
   4. Frames:
      a. Hat-shaped, galvanized steel channels, 0.064-inch minimum thickness.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.

d. Galvanized -steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:
1. 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:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. Flexmaster U.S.A., Inc.
   d. McGill AirFlow LLC.
   e. METALAIRE, Inc.
   f. Ruskin Company.
   g. Trox USA Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
6. Blade Axles: Galvanized steel.
7. Bearings:
   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:
1. Size: 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.

3. Include elevated platform for insulated duct mounting.

2.04 CONTROL DAMPERS

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. American Warming and Ventilating; a division of Mestek, Inc.
   2. Arrow United Industries; a division of Mestek, Inc.
   3. Duro Dyne Inc.
   4. Flexmaster U.S.A., Inc.
   5. Greenheck Fan Corporation.
   6. McGill AirFlow LLC.
   7. METALAIRE, Inc.
   8. NCA Manufacturing, Inc.
   9. Ruskin Company.

B. Frames:
   1. [Galvanized] steel channels, 0.064 inch thick.
   2. Mitered and welded corners.

C. Blades:
   1. Multiple blade with maximum blade width of 8 inches.
   2. Parallel- and opposed -blade design.
   3. Galvanized steel.
   4. 0.064 inch thick.
   5. Blade Edging: Closed-cell neoprene edging.
   6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

D. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
   1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:
   1. Oil-impregnated bronze.
   2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   3. Thrust bearings at each end of every blade.

2.05 FIRE DAMPERS

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. Air Balance Inc.; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. McGill AirFlow LLC.
   4. METALAIRE, Inc.
   5. NCA Manufacturing, Inc.
   6. Prefco; Perfect Air Control, Inc.

7. Ruskin Company.
8. Vent Products Company, Inc.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to [4-inch wg] static pressure class and minimum [4000-fpm] velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, [165 deg F] rated, fusible links.

2.06 SMOKE DAMPERS

A. Manufacurers: Subject to compliance with requirements, provide product by one of the following:
1. Air Balance Inc.; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Greenheck Fan Corporation.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.

E. Blades: Roll-formed, horizontal, overlapping, 0.063-inch- (1.6-mm) thick, galvanized sheet steel.

F. Leakage: Class I

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.039-inch- (1.0-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

I. Damper Motors: Two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
   3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
   5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
   6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
   7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:
   1. Auxiliary switches for position indication.
   2. Test and reset switches, damper mounted.

2.07 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
   1. Air Balance Inc.; a division of Mestek, Inc.
   2. Cesco Products; a division of Mestek, Inc.
   3. Greenheck Fan Corporation.
   4. Nailor Industries Inc.
   5. Pottorff.
   6. Ruskin Company.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.

F. Heat-Responsive Device: Resettable, 165 deg F (74 deg C) rated, fire-closure device.

G. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.

H. Smoke Detector: Integral, factory wired for single-point connection.

I. Blades: Roll-formed, horizontal, overlapping, 0.063-inch- (1.6-mm-) (0.85-mm-)] thick, galvanized sheet steel.

J. Leakage: Class I.

K. Rated pressure and velocity to exceed design airflow conditions.

L. Mounting Sleeve: Factory-installed, 0.05-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

M. Master control panel for use in dynamic smoke-management systems.

N. Damper Motors: Modulating two-position action.

O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
   3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
   4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
   5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
   6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
   7. Electrical Connection: 115 V, single phase, 60 Hz.

P. Accessories:
   1. Auxiliary switches for position indication.

2. Test and reset switches, damper mounted.

2.08 FLANGE CONNECTORS

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. Ductmate Industries, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.09 DUCT-MOUNTED ACCESS DOORS

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. American Warming and Ventilating; a division of Mestek, Inc.
   2. Ductmate Industries, Inc.
   3. Flexmaster U.S.A., Inc.
   4. Greenheck Fan Corporation.
   5. McGill AirFlow LLC.
   6. Ventfabrics, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.

C. Pressure Relief Access Door:
   1. Door and Frame Material: Galvanized sheet steel.
   2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
   3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
   4. Factory set at pressure to be determined by Engineer.

5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.10 FLEXIBLE CONNECTORS

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. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip [3-1/2 inches] wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.11 FLEXIBLE DUCTS

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. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
   2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft or control dampers as shown at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

   1. Adjacent to and close enough to fire , to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed

upstream from dampers and inward operation for access doors installed downstream from dampers.
2. Control devices requiring inspection.
3. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts with maximum [12-inch] lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect flexible ducts to metal ducts with liquid adhesive plus tape.

O. Install duct test holes where required for testing and balancing purposes.

P. Tests and Inspections:
1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire to verify full range of movement and verify that proper heat-response device is installed.

END OF SECTION 23 33 00

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes Dedicated Outdoor Air System (DOAS) units for indoor applications.

1.02 SUBMITTALS

A. Product Data: Submit product data for specified products with the following information.

B. General layout drawing with plan and elevation views including all relevant dimensions.

C. Performance schedule including airflow, heating and cooling capacities, electrical data, unit weight.

D. Full fan curve.

E. Sound power data by octave band for all openings and radiated through the cabinet.

F. Electrical schematics including field wiring connections.

G. Component details including construction method and materials.

H. Control point schematic and complete written sequence of operation.

1.03 QUALITY ASSURANCE

A. Entire unit shall be UL 1812 or UL 1995 certified and bear certification label by ETL, UL or CSA.

B. Unit shall meet ASHRAE Standard 90.1 performance requirements.

C. Unit sound data will be tested in accordance with AHRI 260.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store equipment away from construction areas where it may be damaged and protected from harmful weather conditions.

B. Keep factory shipping packaging in place until unit is ready to be installed.

C. Follow manufacturer's instructions for rigging and placement of equipment.

1.05 COORDINATION

A. Coordinate all system connections and building penetrations including electrical and duct connections.

1.06 WARRANTY

A. Standard Warranty for the Unit: 24 months (2 years) from shipment date

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with project plans and specifications the following manufacturers are approved to supply products.

Acceptable Manufacturers
1. Oxygen8
2. Approved Alternates.

2.02 DOAS Units

A. DOAS units shall be factory assembled and tested. Units shall include insulated steel cabinet, total plate heat exchanger, split DX cooling coil, split HGRH coil, , fan and motor assembly, filter rack, and integral controls. Unit shall have a single point power connection.

2.03 CABINET

A. Cabinet shall be nominal 1-inch double wall panel with R6.5 thermal insulation. Cabinet exterior shall be 22-gauge pre-painted steel that meets or exceeds 650-hour salt spray test based on ASTM B117. Liners and other steel components shall be galvanized steel. All seams shall be sealed to provide airtight casing.

B. Doors shall be nominal 1-inch double wall panel with the same construction as cabinet. Doors shall be fitted with hinges and door handles. The doors shall have one lockable handle as standard.

C. The unit will be designed for service and maintenance on the bottom side only to allow for a compact installation.

2.04 FILTERS

A. Unit shall include 2-inch filter rack for the outdoor air and return air paths upstream of energy recovery exchanger. Filters shall be accessed through hinged filter access door. Supply one set of MERV 13 pleated filters for the outdoor air stream and one set of MERV8 for the return air stream. All filters must be UL approved.

B. Provide factory mounted pressure sensors to measure filter pressure drop across filters. Pressure drop shall be digital feedback to controller for utilization in control and alarm sequencing. Unit controller shall monitor filter pressure level and report when filter changes are required.

2.05 FANS

A. Fans shall be mixed flow plenum type with direct drive motor. Fan and motor assembly shall be factory mounted and balanced. The fans will be capable of operating in ambient temperatures of up to 40°C.

B. Fan motors shall be permanent magnet, synchronous motor type with integral digital motor controller. Fan bearings shall be serviceable type with an L-10 life of 40,000 hours. Fan motors will be UL approved.

C. All fans shall be equipped with integral airflow monitoring system connected to the unit controller.

D. Provide means to easily remove fan-motor assembly for service through standard doors.

E. Fans should be designed such that all service can be performed in the field, including replacement of bearings.

F. Fan motor drives shall be 208/60/3 and be UL approved. Fans will be protected by UL approved motor protection circuit breaker.

2.06 ENERGY RECOVERY DEVICE

A. Where indicated, units shall include plate type counter flow heat exchanger fabricated with a polymer membrane and aluminum casing. Maximum pressure differential shall be 7.2” w.c. Maximum leakage between airstreams shall be 0.5% of nominal airflow.

B. The energy recovery device must have an ISO Hygiene rating of 0.

C. Unit shall include bypass dampers with modulating actuators. Unit controller shall operate bypass dampers to maximize heat transfer without frosting and bypass heat exchanger during economizer mode. Energy recovery device shall be installed over a stainless-steel double sloped condensate pan.

2.07 HEAT RECOVERY DEVICE

A. Where indicated, units shall include AHRI 1060 Certified plate type counter flow heat exchanger fabricated from aluminum. Maximum pressure differential shall be 7.2" w.c. Maximum leakage between airstreams shall be 0.5% of nominal airflow.

B. The heat recovery device shall be installed over a stainless-steel double sloped condensate pan.

C. Unit shall include bypass dampers with modulating actuators. Unit controller shall operate bypass dampers to maximize heat transfer without frosting and bypass heat exchanger during economizer mode.

2.08 DX HEAT PUMP COIL (Heating and Cooling)

A. Where indicated, unit shall include AHRI 410 tested fin tube type DX coil for use with R-410A. Fins shall be aluminum with a minimum thickness of 0.006". Tubes shall be minimum 3/8" OD, minimum 0.014" tube wall seamless copper tube mechanically expanded into fins. Coil shall have interlaced circuits to match remote condensing unit when required. Coil casings shall be galvanized steel. Coils shall include external drain and vent connections. Coil shall be mounted in a rack over a stainless-steel double sloped condensate pan. Coil shall be shipped with nitrogen holding charge and tested to 650 psi.

B. When VRV integration is used, the AHU integration controller (EKEQ) must be factory mounted and wired to EKEXV expansion valve kit.

C. Liquid and Gas thermistors are to be mounted to coil and wired to EKEQ kit in the factory.

D. EKEXV expansion valve kit will be mounted, and connections will be brazed to coil. Liquid and Gas lines to be capped at outside of AHU. Coil and EKEXV kit must be tested to 650 psi, and then nitrogen charged for shipment to site.

2.09 HOT GAS REHEAT COIL

A. Where indicated, unit shall include AHRI 410 tested fin tube type DX coil for use with R-410A. Fins shall be aluminum with a minimum thickness of 0.006". Tubes shall be 3/8" OD, minimum 0.014" tube wall seamless copper tube mechanically expanded into fins. Coil shall have interlaced circuits to match remote condensing unit when required. Coil casings shall be galvanized steel. Coils shall include external drain and vent connections. Coil shall be mounted in a rack over a stainless-steel double sloped condensate pan. Coil shall be shipped with nitrogen holding charge and tested to 650 psi.

B. When VRV integration is used, the AHU integration controller (EKEQ) must be factory mounted and wired to EKEXV expansion valve kit.

C. Liquid and Gas thermistors are to be mounted to coil and wired to EKEQ kit in the factory.

D. EKEXV expansion valve kit will be mounted, and connections will be brazed to coil. Liquid and Gas lines to be capped at outside of AHU. Coil and EKEXV kit must be tested to 650 psi, and then nitrogen charged for shipment to site.

2.10 CONTROLS

A. Unit shall include an integrated microprocessor-based unit controller. The controls shall be located in the externally mounted electrical enclosure. All unit controls shall operate off a transformer from the main power supply for single point power connection. All internal controls and sensors shall be factory prewired and tested.

B. Include with each unit a dial type human interface that allows monitoring and control of all unit functions. Human interface shall communicate with unit controller by hardwire connection.

C. The control system will regulate temperatures, airflows and other functions as required. Unit controller shall be pre-programmed with factory tested software for all possible functions.

D. The controller shall provide the following, refer to sequence of operation for specific unit control sequences;

1. Control of fans correcting for both changes in total static pressure and air density in both VAV and constant airflow applications.
2. Fan performance monitoring.
3. Ventilation airflow monitoring and control.
4. Airflow density correction for winter and summer conditions.
5. Energy recovery optimization including operation of bypass damper.
6. Supplemental heating and cooling when included.
7. Frost protection.
8. Monitoring alarms, faults and maintenance points including filter changeout.
9. Time and date schedules.
10. Humidity control.
11. Data logging and trending.

E. Include wireless capability that will allow the client to access remotely via internal wi-fi network.

F. If non factory controls are proposed as an option, a factory witness test is required to show integration and functionality.

G. Controller shall be BACnet IP and BTL certified and include Modbus communication. Communication shall include monitoring, control, alarms, faults and maintenance information.

H. Provide factory installed and tested contactors, overloads, fusing, starters motor speed controllers for supply and exhaust. Include all necessary control transformers.

I. Provide unit mounted non-fused disconnect switch with single point power connection.

J. Supply all necessary temperature and pressure sensors complete with plug in wiring harnesses for proper option of unit.

K. When VRV integration is used, the AHU integration controller (EKEQ) must be factory mounted and wired to EKEXV expansion valve kit.

L. Liquid and Gas thermistors are to be mounted to coil and wired to EKEQ kit in the factory.

2.11 PLASTIC COMPONENTS

A. All plastic components that are in the airstream, must be of a UL94 rated material.

B. If gasketing is used to join unit sections together, gasketing must be a UL94 approved compound.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment in accordance with manufacturer instructions, these specifications, best practices, and all applicable building codes.

3.02 START UP SERVICE

A. Engage factory authorized service technician to start up and commission units. Provide start up report to owner.

END OF SECTION 23 74 33

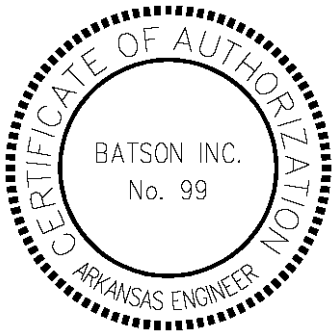
SPECIFICATIONS: DIVISIONS 26, 27 and 28

PROJECT: CRAIGHHEAD ELECTRIC COOPERATIVE
MAINTENANCE SHOP ADDITION – JONESBORO, AR

DATE: February 14, 2025

BATSON INC. PROJECT NO.: 6106

Chris W. Mann, P.E.



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PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type XHHW-2.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.03 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Aluminum conductors are not allowed unless specifically stated on plans.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-2-THWN-2, single conductors in raceway. Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway. Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway. Type XHHW-2, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

F. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway. Type XHHW-2, single conductors in raceway.

I. Branch Circuits Installed below Raised Flooring: Type THHN-2-THWN-2, single conductors in raceway.

J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors where aluminum conductors are allowed as indicated on plans.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 26 99 00 “Fireproofing Materials and Methods”.

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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. Burndy; Part of Hubbell Electrical Systems.
   2. Dossert; AFL Telecommunications LLC.
   3. ERICO International Corporation.
   4. Fushi Copperweld Inc.
   5. Galvan Industries, Inc.; Electrical Products Division, LLC.
   6. Harger Lightning and Grounding.
   7. ILSCO.
   8. O-Z/Gedney; A Brand of the EGS Electrical Group.
   9. Robbins Lightning, Inc.
   10. Siemens Power Transmission & Distribution, Inc.

2.02 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.03 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
   1. Bonding Conductor, Main: Insulated copper conductor sized to meet requirements of section 250.28 and table 250.102(C)(1) of the latest edition of the NEC.
   2. Bonding Jumper, System: Insulated copper conductor sized to meet requirements of section 250.28, 250.30, and table 250.102(C)(1) of the latest edition of the NEC.
   3. Bonding Jumper, Supply Side: Insulated copper conductor sized to meet the requirements of sections 250.30, 250.102, and table 250.102(C)(1) of the latest edition of NEC.
   4. Bonding Jumper, Branch Circuits and Equipment: Insulated copper conductor sized to meet the requirements of table 250.122 of the latest edition of the NEC.
   5. Grounding Electrode Conductor: Insulated copper conductor sized to meet the requirements of section 250.66 and table 250.66 of the latest section of the NEC.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.

2.04 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.05 GROUNDING ELECTRODES

A. Ground Rods: Copper-bonded steel with 10 mil copper plating, minimum; 3/4 inch by 10 feet.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
   1. Bury at least 24 inches below grade unless noted otherwise.

C. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors.
   3. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-

tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.04 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 26 05 26

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Factory-fabricated components for field assembly.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.
g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating.
5. Painted Coatings: Manufacturer's standard painted coating.
6. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

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

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts.
   2. To New Concrete: Bolt to concrete inserts.
   3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   4. To Existing Concrete: Expansion anchor fasteners.
   5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
   6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
   7. To Light Steel: Sheet metal screws.
   8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated on plans.

B. Unless otherwise noted on structural plans, use 3000-psi, 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with the specification requirements for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.

1.02 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.01 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel or aluminum.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
   a. Material: Steel.
   b. Type: Compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated on plans.

C. LFNC: Comply with UL 1660.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: Comply with UL 514B.

2.03 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, and sized according to NFPA 70. Type suitable for installation location and application.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:
   1. Material: Cast metal.
   2. Type: Fully adjustable.
   3. Shape: Rectangular, unless otherwise indicated.
   4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular, unless otherwise indicated.
   1. Listing and Labeling:

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

L. Gangable boxes are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250. Type suitable for installation location and application with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:
   1. NEMA 250, Galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Cabinet type must be listed and suitable for installation location and application.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
   1. Exposed Conduit: GRC.
   2. Concealed Conduit, Aboveground: GRC.
   3. Underground Conduit: RNC, Type EPC-40-PVC. Encase RNC in 4" of concrete where subject to crushing from vehicular traffic.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
   3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Mechanical and Electrical rooms.
      d. Gymnasiums.
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   6. Damp or Wet Locations: GRC.
   7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
   3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
   4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.02 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in 260529.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit

close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC, Type EPC-40-PVC to GRC or EMT before rising above floor. Type of conduit that shall be installed above floor will be dependent on location of conduit stub-up.

I. Stub-ups to Above Recessed Ceilings:
   1. Use EMT or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch radius control at bend points.
   2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:
   1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet.
   2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
      a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
      b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
      c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
      d. Attics: 135 deg F temperature change.
   3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F of temperature change for PVC conduits.
   4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
   5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.
   2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

1.	Convenience Receptacles	18” or as directed
2.	Brackets	As directed
3.	Switches `	48” or as directed
4.	Telephone Outlets	18” or as directed
5.	Other Outlets	As directed or indicated
6.	Over Counters	6” above countertop

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Locate boxes so that cover or plate is not modified to install device. Field modification or cutting of device covers is not allowed.

Y. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

AA. Set metal floor boxes level and flush with finished floor surface.

BB. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit.
2. Install backfill as required by other sections of these specifications.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as required in other sections of these specifications.
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 4 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Install underground warranty type as required by other sections of these specifications.

3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.05 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 26 99 00 “Fireproofing Materials and Methods”.

3.06 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
    1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
    2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
   2. Sleeve-seal systems.
   3. Sleeve-seal fittings.
   4. Grout.
   5. Silicone sealants.

B. Related Requirements: Section 26 99 00 “Fireproofing Materials and Methods” for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

PART 2 - PRODUCTS

2.01 SLEEVES

A. Wall Sleeves:
   1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
   1. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:
   1. Material: Galvanized sheet steel.
   2. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
      b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.02 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. 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:
      a. Advance Products & Systems, Inc.
      b. CALPICO, Inc.
      c. Metraflex Company (The).
      d. Pipeline Seal and Insulator, Inc.
      e. Proco Products, Inc.
   2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Carbon steel.
   4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.03 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
   1. 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:
      a. Presealed Systems.

2.04 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.05 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch

annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.03 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Restraint channel bracings.
   2. Restraint cables.
   3. Seismic-restraint accessories.
   4. Mechanical anchor bolts.
   5. Adhesive anchor bolts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each seismic-restraint device.
   1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic and wind forces required to select seismic and wind restraints.
      a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
   3. Seismic and Wind-Restraint Details:

a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: **[115 mph]**.
2. Building Classification Category: **[II]**.
3. Minimum 10 lb/sq. ft. multiplied by maximum area of HVAC component projected on vertical plane normal to wind direction and 45 degrees either side of normal.

B. Seismic-Restraint Loading:
1. Site Class as Defined in the IBC: **[D].**
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: **[II]**.
   a. Component Importance Factor (Lighting Fixtures, Panelboards, Disconnects, Starters, Conduit/Cable Tray, Generator, Automatic Transfer Switch): [**1.0**]
   b. Component Importance Factor (Emergency Lighting Fixtures, Exit Lights, Egress Lights): **[1.5]**.
   c. Component Response Modification Factor: **Refer to ASCE 7-16, Table 13.6-1 for electrical component Modification Factors**.
   d. Component Amplification Factor: **Refer to ASCE 7-16, Table 13.6-1 for electrical component Amplification Factors.**
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): **[Ss = 1.56]**.
4. Design Spectral Response Acceleration at 1.0-Second Period: **[S1 = 0.420]**.

2.02 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.03 RESTRAINT CABLES

A. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.04 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.05 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.06 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required from seismic engineering design calculations and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.02 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:
   1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
   2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES or an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install cables so they do not bend across edges of adjacent equipment or building structure.

C. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

E. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
   2. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   3. Test to 90 percent of rated proof load of device.

B. Seismic controls will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 48

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Identification for conductors.
2. Underground-line warning tape.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.02 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

C. Comply with ANSI Z535.4 for safety signs and labels.

D. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.01 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Insulation: For branch circuits and feeders supplying systems of 277/480V, the means of identification shall be by conductor insulation color of brown, orange, yellow, and gray.

B. Color-Coding Conductor Insulation: For branch circuits and feeders supplying systems of 120/208V, the means of identification shall be by conductor insulation color of black, red, blue, and white.

C. All equipment ground conductors shall be identified by means of conductor insulation color of green.

2.02 UNDERGROUND-LINE WARNING TAPE

A. Tape:
   1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
   2. Printing on tape shall be permanent and shall not be damaged by burial operations.
   3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Tape Requirements:
   1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
   2. Overall Thickness: 5 mils.
   3. Foil Core Thickness: 0.35 mil.
   4. Weight: 28 lb/1000 sq. ft..
   5. 3-Inch Tensile According to ASTM D 882: 70 lbf, and 4600 psi.

C. Color and Printing:
   1. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
   2. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.03 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
   2. 1/4-inch grommets in corners for mounting.
   3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.04 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
   1. Engraved legend with white letters on black face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.05 EQUIPMENT IDENTIFICATION LABELS

A. Laminated Acrylic or Melamine Plastic Signs:
   1. Engraved legend.
   2. Thickness:
      a. For signs up to 20 sq. inches, minimum 1/16-inch.
      b. For signs larger than 20 sq. inches, 1/8 inch thick.
      c. Engraved legend with white letters on a black background.
      d. Self-adhesive.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Power-Circuit Conductor Identification, 600 V or Less: Use conductor insulation colors as noted below.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
    a. Colors for 208/120-V Circuits:
        1) Phase A: Black.
        2) Phase B: Red.
        3) Phase C: Blue.
        4) Neutral: White.
    b. Colors for 480/277-V Circuits:
        1) Phase A: Brown.
        2) Phase B: Orange.
        3) Phase C: Yellow.
        4) Neutral: Gray.
    c. Color for all Circuits:
        1) Equipment Ground: Green.
    d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in

boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

C. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.

G. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

H. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide three lines of text with 1/2-inch- high letters on 2-1/2-inch-high label; where two lines of text are required, use labels 2 inches high. First line of text shall include equipment designation as shown on plans schedules. Second line of text

shall indicate where equipment is fed from and read as follows "FED from XXX". The third line of text shall indicate the equipment amperage rating, voltage rating, phase and wiring system (Ex. 3W or 4W).

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 26 05 53

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.03 DEFINITIONS

A. Retain terms that remain after this Section has been edited for a project.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.04 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

    a. Short-circuit study input data, including completed computer program input data sheets.
    b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

        1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
        2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.06 CLOSEOUT SUBMITTALS

C. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
2. The following are from the Short-Circuit Study Report:

    a. Final one-line diagram.
    b. Final Short-Circuit Study Report.
    c. Short-circuit study data files.
    d. Power system data.

1.07 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Comply with IEEE 399 and IEEE 551.

1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

B. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by the study.

D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.
2. Power sources available.
3. Manufacturer, model, and interrupting rating of protective devices.
4. Conductors.
5. Transformer data.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.

d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.01 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer

in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.02 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems.

Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 26 05 73.13

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1. Study results shall be used to determine coordination of series-rated devices.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.04 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

    a. Coordination-study input data, including completed computer program input data sheets.
    b. Study and equipment evaluation reports.

3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power System Analysis Software Developer.
2. For Power Systems Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. The following are from the Coordination Study Report:

    a. Final one-line diagram.
    b. Final protective device coordination study.
    c. Coordination study data files.
    d. List of all protective device settings.
    e. Time-current coordination curves.
    f. Power system data.

1.07 QUALITY ASSURANCE

A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications:

1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Comply with IEEE 242 and IEEE 399.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.

c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.02 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.
6. Any revisions to electrical equipment required by the study.
7. Study Input Data: As described in "Power System Data" Article.

a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

D. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, and ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists

between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.03 COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:

    1. To normal system low-voltage load buses where fault current is 10 kA or less.
    2. Exclude equipment rated 240 V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

   a. Inrush current when first energized.
   b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
   c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. Any application of series-rated devices shall be recertified, complying with requirements in NFPA 70.
4. Include in the report identification of any protective device applied outside its capacity.

3.04 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.05 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.06 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.07 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.

2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 26 05 73.16

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.03 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.

C. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

G. SCCR: Short-circuit current rating.

H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

I. Single-Line Diagram: See "One-Line Diagram."

1.04 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form:

1. Arc-flash study input data, including completed computer program input data sheets.
2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.07 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

G. Field Adjusting Agency Qualifications:

1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. A member company of NETA.
3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 COMPUTER SOFTWARE DEVELOPERS

A. Comply with IEEE 1584 and NFPA 70E.

B. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.02 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.

3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

G. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.
    e. Equivalent impedance.
    f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.03 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Protection boundaries.

    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.

4. Arc flash PPE category.
5. Required minimum arc rating of PPE in Cal/cm squared.
6. Available incident energy.
7. Working distance.
8. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.

1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

C. Calculate maximum and minimum contributions of fault-current size.

1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.

D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

F. Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.03 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.

2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance or available short circuit current at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.04 LABELING

A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each

equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Medium voltage transformers
6. Low voltage transformers.
7. Panelboard and safety switch over 250 V.
8. Applicable panelboard and safety switch under 250 V.
9. Control panel.

C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. Indicate arc-flash energy.
2. Indicate protection level required.

3.05 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.06 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 26 05 73.19

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
   1. Distribution transformers.

1.02 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Indicate dimensions and weights.
   1. Wiring Diagrams: Power, signal, and control wiring.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Square D; Schneider Electric.
   2. Eaton Electrical Inc.; Cutler-Hammer Products.
   3. General Electric Company.

2.02 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.
   1. Internal Coil Connections: Brazed or pressure type.
   2. Coil Material: Aluminum.

2.03 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.
   1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Transformer Enclosure Finish: Comply with NEMA 250.
   1. Finish Color: ANSI 49 gray.

E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

G. Energy Efficiency for Transformers Rated 15 kVA and Larger:
   1. Complying with NEMA TP 1, Class 1 efficiency levels.
   2. Tested according to NEMA TP 2.

2.04 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate. Nameplates are specified in Section 26 05 53 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

B. Provide tightly fastened equipment grounding and bonding connectors for transformers as indicated and required by the NEC.

C. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

D. Install units on vibration mounts as shown; comply with manufacturer's indicated installation method. Connect transformer with flexible conduit for both primary and secondary feeders.

E. Connect transformer units to electrical wiring system. Comply with requirements of other Division 16 sections. Wiring connections to be in strict conformity with NEC.

3.02 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

3.03 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results upon request by Engineer.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 26 22 00

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.
1. Detail enclosure types and details for types other than NEMA 250, Type 1.
2. Detail bus configuration, current, and voltage ratings.
3. Short-circuit current rating of panelboards and overcurrent protective devices.
4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Panelboard schedules for installation in panelboards.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within a specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush or surface-mounted cabinets as indicated on plans.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
      c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X stainless steel.
      d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top or bottom as indicated on plans.

D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

E. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.03 DISTRIBUTION PANELBOARDS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

C. Panelboards: NEMA PB 1, power and feeder distribution type.

D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

E. Mains: Circuit breaker or Lugs only as indicated on plans.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

G. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

D. Mains: Circuit breaker or lugs only as indicated on plans.

E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I2t response.

4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

H. Comply with NECA 1.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform a visual and mechanical inspection of all connections within each panelboard.
   2. Tighten all loose panelboard connections prior to final acceptable by Owner.

D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 24 16

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Weather-resistant receptacles.
   3. Wall-box dimmers.
   4. Wall switches, and associated device plates.

1.02 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.04 GFCI RECEPTACLES

A. General Description:
1. Straight blade, feed non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; VGF20.
b. Hubbell; GFR5352L.
c. Pass & Seymour; 2095.
d. Leviton; 7590.

2.05 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Single Pole:
b. Cooper; AH1221.
c. Hubbell; HBL1221.
d. Leviton; 1221-2.
e. Pass & Seymour; CSB20AC1.
f. Two Pole:
g. Cooper; AH1222.
h. Hubbell; HBL1222.
i. Leviton; 1222-2.
j. Pass & Seymour; CSB20AC2.
k. Three Way:
l. Cooper; AH1223.
m. Hubbell; HBL1223.
n. Leviton; 1223-2.
o. Pass & Seymour; CSB20AC3.
p. Four Way:
q. Cooper; AH1224.
r. Hubbell; HBL1224.
s. Leviton; 1224-2.
t. Pass & Seymour; CSB20AC4.

2.06 DECORATOR-STYLE DEVICES

A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Cooper; 6352.
b. Hubbell; DR20.
c. Leviton; 16352.
d. Pass & Seymour; 26352.

B. GFCI, Feed Non-Feed-through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and UL 943 Class A.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; VGF20.
      b. Hubbell; GF20LA.
      c. Leviton; 7899.
      d. Pass & Seymour; 2094.

C. Toggle Switches, Square Face, 120/277 V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 7621 (single pole), 7623 (three way).
      b. Hubbell; DS120 (single pole), DS320 (three way).
      c. Leviton; 5621-2 (single pole), 5623-2 (three way).
      d. Pass & Seymour; 2621 (single pole), 2623 (three way).

D. Lighted Toggle Switches, Square Face, 120 V, 20 A: Comply with NEMA WD 1 and UL 20.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cooper; 7631 (single pole), 7633 (three way).
      b. Hubbell; DS120IL (single pole), DS3IL (three way).
      c. Leviton; 5631-2 (single pole), 5633-2 (three way).
      d. Pass & Seymour; 2625 (single pole), 2626 (three way).
   2. Description: With neon-lighted handle, illuminated when switch is "off."

2.07 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

2.08 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact thermoplastic unless noted otherwise.

3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic. Unless noted otherwise on plans, default material for device plates shall be thermoplastic.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.09 FINISHES

A. Device Color:
1. Wiring Devices Connected to Normal Power System: As selected by Architect/Engineer unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.
3. TVSS Devices: Blue.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.02 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

B. Downstream feeding of receptacles to accomplish GFCI protection in lieu of providing GFCI receptacles shown or plans is not allowed.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 26 27 26

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Shunt trip switches.
   4. Molded-case circuit breakers (MCCBs).
   5. Enclosures.

1.02 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.04 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 FUSIBLE SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Square D; a brand of Schneider Electric.
   2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

C. Type HD, Heavy Duty, Single Throw, 240 and/or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Lugs: Suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Square D; a brand of Schneider Electric.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

D. Type HD, Heavy Duty, Single Throw, 240 and/or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Suitable for number, size, and conductor material.

2.03 MOLDED-CASE CIRCUIT BREAKERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Square D; a brand of Schneider Electric.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I2t response.

F. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Suitable for number, size, trip ratings, and conductor material.
   3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
   4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
   5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
   6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
   7. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
   2. Outdoor Locations: NEMA 250, Type 3R.
   3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
   4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.02 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual testing same as panelboards and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 28 16

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:
   1. Full-voltage manual.
   2. Full-voltage magnetic.

1.02 DEFINITIONS

A. Retain definition(s) remaining after this Section has been edited.

B. CPT: Control power transformer.

C. MCCB: Molded-case circuit breaker.

D. MCP: Motor circuit protector.

E. N.C.: Normally closed.

F. N.O.: Normally open.

G. OCPD: Overcurrent protective device.

1.03 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.04 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
   1. Wiring Diagrams: For power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

B. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.07 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

PART 2 - PRODUCTS

2.01 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Square D; a brand of Schneider Electric.
      b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      c. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Configuration: Nonreversing.
   4. Surface mounting.
   5. Pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Square D; a brand of Schneider Electric.
      b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      c. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Configuration: Nonreversing.
   4. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; melting alloy type.
   5. Surface mounting.
   6. Pilot light.

D. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Square D; a brand of Schneider Electric.
      b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      c. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Configuration: Nonreversing.
   4. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters and sensors in each phase, matched to nameplate full-load current of actual protected motor and having appropriate adjustment for duty cycle; external reset push button; melting alloy type.
   5. Surface mounting.
   6. Pilot light.

E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Square D; a brand of Schneider Electric.

b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
c. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Fusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
4. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
5. Nonfusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
6. MCP Disconnecting Means:
   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
7. MCCB Disconnecting Means:
   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
   b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.

2.02 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
   1. Dry and Clean Indoor Locations: Type 1.
   2. Outdoor Locations: Type 3R.
   3. Kitchen and Wash-Down Areas: Type 4X, stainless steel.
   4. Other Wet or Damp Indoor Locations: Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.03 ACCESSORIES

A. Push Buttons, Pilot Lights, and Selector Switches: NEMA ICS 5; heavy-duty type; factory installed in controller enclosure cover unless otherwise indicated.

B. Control Relays: Auxiliary and adjustable time-delay relays.

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height, and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Seismic Bracing: Comply with requirements specified in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch enclosed controller.

E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

F. Comply with NECA 1.

3.02 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.03 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices [and facility's central control system]. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:
1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

3.05 ADJUSTING

A. Set field-adjustable switches and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

3.06 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 26 29 13

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Diesel engine.
2. Diesel fuel-oil system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Outdoor engine generator enclosure (where selected).
7. Vibration isolation devices (where applicable).

B. Related Requirements:

1. Section 26 36 23 "Automatic Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.02 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in gallons per hour (liters per hour) at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.

5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include airflow requirements for cooling and combustion air in cubic feet per minute (cubic meters per minute) at 0.8 power factor, Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight for provided components; fuel tank, enclosure, silencer, base tank, each piece of equipment not integral to the engine generator.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams indicating terminal markings for engine generators and functional relationship between all electrical components.
7. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

1.04 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report. Perform tests at rated load and power factor. Provide the following test results:

a. Maximum Power Level
b. Maximum Motor Starting (sKVA)
c. Structural Soundness
d. Torsional Analysis
e. Transient Response
f. Alternator Temperature Rise
g. Engine Cooling Requirements (unit mounted radiator)
h. Harmonic Analysis (per IEEE-115 and ANSI-100)
i. Voltage Regulation
j. Endurance Testing

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Report of factory test on units to be shipped for this Project, indicating evidence of compliance with specified requirements.
4. Report of sound generation.
5. Report of exhaust emissions indicating compliance with applicable regulations.
6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

C. Field quality-control reports. Field start up report and unit in-service documentation, including load bank test results if applicable.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Include manufacturer's recommended maintenance and periodic testing plan in accordance with NFPA 110, Chapter 8.

B. Furnish extra materials required by local Authority Having Jurisdiction (AHJ) and defined in project documents that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.06 QUALITY ASSURANCE

A. The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in accordance with all applicable standards below:

1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
2. CSA C22.2, No. 100 Motors and Generators
3. CSA 282-15
4. EN 61000-6
5. EN 55011
6. FCC Part 15 Subpart B
7. ISO 8528

8. IEC 61000
9. UL 508
10. UL 2200
11. UL 142
12. UL 6200
13. Designed to allow for installed compliance to NFPA 37, NFPA 70, NFPA 99 and NFPA 110

B. Manufacturer Qualifications:

1. Current certificate holder for ISO 9001 compliance.
2. The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 25 years and who maintains a service organization of factory-authorized generator technicians available twenty-four hours a day throughout the year.
3. Manufacturing and assembly of products must be done in the United States using domestically sourced materials to the extent practical.

C. Installer Qualifications: An authorized representative who is trained and certified by the manufacturer on stationary power systems.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty: 5 Year Comprehensive from date of Substantial Completion.
2. A Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period. A Limited warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for the first 2 years and then replacement parts for the remainder of the listed warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Generac Power Systems, Inc.; 500 kW, 15.2L with a K0600124Y23 - 500kW alternator. The Three Phase generator shall be rated for 500 kW at 208 volts and 60 Hz, at 0.8 power factor lagging while operating at a maximum ambient temperature of 104 Fahrenheit and maximum altitude of 3000 feet above sea level

without reduction in electrical output capacity. Comparable products by one of the following will also be considered:

1. Kohler Power Systems

B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer. "Source Limitations: Obtain packaged engine generators and auxiliary components from single supplier. The equipment supplied and installed shall meet the requirements of NEC and all applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory certified service personnel.

C. Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data and a completed generator sizing model using the proposed manufacturer's generator sizing software shall accompany each request and authorized acceptance shall be addenda only. Should any substitutions be made, the contractor shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

2.02 PERFORMANCE REQUIREMENTS

A. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 EPSS.

B. UL Compliance: Engine generator assembly and factory enclosure (if provided) shall be UL 2200 listed.

C. Engine Exhaust Emissions: Comply with applicable US EPA, State and Local Government requirements. Diesel Stationary Emergency: Engines shall be certified by the manufacturer to comply with 40 CFR Part 60 Subpart IIII.

2.03 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Standby.

D. Service Load: The generator set shall be a Generac model 500 kW, 15.2L with a K0600124Y23 - 500kW alternator. It shall provide 500 kW and 625 kVA while operating at the maximum ambient operating temperature and elevation specified in the project documents.

E. Power Factor: 0.8 lagging.

F. Frequency: 60 Hz.

G. Voltage: 208 Volts ac.

H. Phase: Three Phase, Four Wire.

I. Induction Method: Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.

L. Nameplates: For each major system component to identify manufacturer's name, model and serial number of component.

M. Engine Generator Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 11.67 percent variation for 50 percent step-load increase or decrease at unity power factor. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 4.0 Hertz variation for 50 percent step-load increase or decrease at unity power factor. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined in accordance with NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of

rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start time to comply with NFPA system requirements.

2.04 ENGINE PERFORMANCE

A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15. Engine shall be capable of operating on hydrotreated vegetable oil blends (up to HVO 100) conforming to the EN 15940 specification without modification.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System to be engine mounted.

1. Oil filter shall be engine-mounted replaceable cartridge type with integral bypass valve, in accordance with manufacturer recommendations.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Jacket Coolant Heater: Jacket water heater shall be sized per NFPA110 and UL listed to ensure that genset will start within the specified time period and ambient conditions.

E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
2. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.
3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
4. Maximum Ambient Operating Temperature on Radiator: 122 degrees F (50 degrees C).
5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.

    a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    b. Meets SAE 100R1A Type S, EN853 1SN, ISO 1436-1 Type 1SN

c. a Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:

1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

G. Air-Intake Filter: Heavy duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12 or 24-V electric, with negative ground.

1. Cranking Cycle: As required by NFPA 110 for system level specified.
2. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle as required by NFPA 110 for system level specified.
3. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 minimum continuous rating.
4. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and NFPA 110 Section 5.6.4.6 for Level 1 systems.

2.05 FUEL SYSTEM – DIESEL

A. Comply with NFPA 37.

B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in Section 231113 "Facility Fuel-Oil Piping." Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.

C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.

D. Fuel Filtering: Remove water and contaminants larger than 2 microns.

E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

F. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:

1. Tank level indicator.
2. Fuel-Tank Capacity: Sized for 24 running hours at 100% of rated generator load between fuel refills.
3. Leak detection in interstitial space.

4. Vandal-resistant fill cap.
5. Containment Provisions: Comply with requirements of authorities having jurisdiction. Secondary containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a primary tank rupture.
6. Normal and emergency vents on the main tank and secondary containment space, sized according to UL 142.

2.06 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

D. Control panel must comply with UL 6200. The controller shall meet ASTM B117 (salt spray test).

E. Connection to Building Management: Provide connections for data transmission of indications to remote data terminals via Modbus.

F. Environmentally Hardened Design: Open circuit boards, edge cards, and PC ribbon cable connections are unacceptable.

G. PCB Construction: Circuit boards with surface-mounted components to provide vibration durability. Circuit boards utilizing large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

H. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the

control panel from engine generator vibration. Panel powered from the engine generator battery.

I. Control and Monitoring Panel:

1. Digital engine generator controller with integrated touch screen, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.

    a. Engine lubricating-oil pressure gauge.
    b. Engine-coolant temperature gauge.
    c. DC voltmeter (alternator battery charging).
    d. Running-time meter.
    e. AC voltmeter, for each phase.
    f. AC ammeter, for each phase.
    g. AC frequency meter.
    h. Generator-voltage adjusting feature.

3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:

    a. Cranking control equipment.
    b. Run-Off-Auto switch.
    c. Control switch not in automatic position alarm.
    d. Overcrank alarm.
    e. Overcrank shutdown device.
    f. Low-water temperature alarm.
    g. High engine temperature pre-alarm.
    h. High engine temperature.
    i. High engine temperature shutdown device.
    j. Overspeed alarm.
    k. Overspeed shutdown device.
    l. Low fuel main tank.

        1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required for the indicated EPSS class.

    m. Coolant low-level alarm.
    n. Coolant low-level shutdown device.
    o. Coolant high-temperature prealarm.
    p. Coolant high-temperature alarm.
    q. Coolant low-temperature alarm.
    r. Coolant high-temperature shutdown device.
    s. EPS load indicator.

t. Battery high-voltage alarm.
u. Low cranking voltage alarm.
v. Battery-charger malfunction alarm.
w. Battery low-voltage alarm.
x. Lamp test.
y. Contacts for local and remote common alarm.
z. Remote manual stop shutdown device.
aa. Total engine run hours, non-resettable.
bb. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

J. External Alarm & Status Relays: Provide a separate terminal block, factory wired to Form C dry contacts, for each alarm and status condition required by Building Management or other external systems as shown on electrical drawings.

K. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

L. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

1. Overcrank alarm.
2. Low water-temperature alarm.
3. High engine temperature pre-alarm.
4. High engine temperature alarm.
5. Low lube oil pressure alarm.
6. Overspeed alarm.
7. Low fuel main tank alarm.
8. Low coolant level alarm.
9. Low cranking voltage alarm.
10. Contacts for local and remote common alarm.
11. Audible-alarm silencing switch.
12. Air shutdown damper when used.
13. Run-Off-Auto switch.
14. Control switch not in automatic position alarm.
15. Fuel tank derangement alarm.
16. Fuel tank high-level shutdown of fuel supply alarm.
17. Lamp test.
18. Low-cranking voltage alarm.
19. Generator overcurrent-protective-device not-closed alarm.

M. Remote Emergency-Stop Switch: Provide remote emergency stop switch in quantity and style as shown on electrical drawings. Electrical contractor to coordinate exact location with engineer and local AHJ.

N. Data Logging:

1. Event Logging – the controller keeps a record of up to 8,000 events with date and time locally for warning and shutdown faults. This event log can be downloaded onto a USB storage device or onto a PC through the service program.
2. Event Snapshot – the control system shall capture 15 seconds of critical data around the time a fault or warning. This data shall be viewable on the controller and downloadable.
3. Data Logging – the controller shall allow customized parameters to be logged based on a start trigger from the controller interface.

    a. The parameters are selectable from all monitored parameters.
    b. The sample period shall be configurable from 1 second to 1 day.
    c. The collected data shall be stored on a USB storage device plugged into the control panel.

2.07 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.

1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.

2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Unit mounted circuit breakers. Rating, ampacity, accessories, as shown on drawings or as listed below:
2. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:

    a. Tripping Characteristic: Designed specifically for generator protection.
    b. Trip Rating: Matched to generator output rating.
    c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
    d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Generator Controller Integrated Alternator Protective Functions:

1. Short-time I^2t function: Generator controller-based function shall continuously monitor current level in each phase of alternator output, integrate alternator heating effect over time, and predict when thermal damage of alternator will occur. As overcurrent heating effect on the alternator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits.
2. Long-time function: Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
3. Short-circuit fault clearing: Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.08 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Range: Provide range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity. Stator shall be skewed construction to minimize harmonic voltage distortion.

G. Enclosure: Drip proof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator:

1. Voltage Regulator: Solid-state type, separate from exciter. The digital voltage regulator shall be microprocessor based with fully programmable operating and protection characteristics. The regulator shall maintain steady-state generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS. The regulator shall provide an adjustable Volts/Hz slope regulation characteristic in order to optimize voltage and frequency response for site conditions.
2. Alternator Excitation: Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
3. The generator must accept rated load in one-step.
4. Calculated Transient Voltage Performance: Motor starting performance and voltage dip determinations shall be based on the complete generator assembly. Voltage dip shall not exceed 11.3 percent based on the largest project block load, as determined by manufacturer's sizing program.
5. System Transient Voltage Performance: Alternator shall be capable of supplying 1200 sKVA with a voltage dip not more than 35% at 0.3 starting power factor. Sustained voltage dip data or manufacturer-published SKVA numbers based on unity PF alternator-only dynamometer testing will not be accepted.
6. Calculated Transient Frequency Performance: Transient frequency dip performance shall be based on the complete generator set. Maintain frequency within 6.5 percent based on largest project block load, as determined by manufacturer's sizing program.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point. The strip heater shall be wired directly to the incoming power distribution panel or load center.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

2.09 OUTDOOR ENGINE GENERATOR ENCLOSURE

A. Basis of design is a Sound Attenuated Level 1 Weather Enclosure.

B. Generator packaged within manufacturer's weather protective, sound attenuated enclosure. Enclosure and generator set shall be UL 2200 Listed as a system.

C. Enclosure Construction: Minimum 14 gauge construction. Roof construction shall be raised-seam, gasket-free interlocking panels. Rivets shall not be used on external painted surfaces. Design shall be rodent resistant.

D. Doors shall be equipped with lift-off pin and sleeve type hinges to allow access to the engine, alternator, and control panel. Hinges shall be adjustable for door alignment. Hinges and all exposed fasteners shall be stainless steel. Each door shall

be equipped with minimum 2-point latching mechanism and identical keys. Perimeter of all door openings shall include polyethylene gasket.

E. Upward discharging exhaust hood for engine cooling airflow and exhaust.

F. Engine exhaust silencer mounted within enclosure discharge hood.

G. Enclosure Finish: Electrostatic applied powered paint, baked and finished to manufacturer's specifications. Finish system shall be subjected to the following tests:

1. ASTM D1186 - 87; 2.5+ mil Paint Thickness
2. ASTM D3363 - 92a; Material Hardness
3. ASTM D522 - B; Resistance to Cracking
4. ASTM D3359 - B; Adhesion
5. ASTM B117 D 1654; Resistant to Salt Water Corrosion
6. ASTM D1735 D 1654; Resistant to Humidity
7. ASTM 2794 93 (2004); Impact Resistance
8. SAE J1690 - UV Protection"

H. Enclosure Color: Manufacturer's standard color, or custom color matched based on architect's design with color sample provided to generator manufacturer.

I. Wind Rating: Enclosure shall be constructed to attain basic wind speed rating of 110 MPH; WIF 1.15, Exposure Category "C", Building Classification "Enclosed", Topographic Factor Kzt = 1. Wind Design Pressures: windward, 20.6 lb/ft^2; leeward, -12.9 lb/ft^2; roof, -18.0 lb/ft^2."

J. Snow Load Rating: Minimum 70 pounds per square foot.

K. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.

L. Sound Insulation: Enclosure and air discharge hood completely lined with reflective silver mylar faced sound attenuating closed cell foam that meets UL 94 HF1 standards for flammability (FMVSS 302 test method). Roof sound insulation panels shall include additional mechanical retention.

M. Sound Performance: The engine generator, while operating at full rated load, shall not exceed 86.00 dBA average measured at 23 ft (7 meters) from the engine generator in a free field environment.

N. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.

O. Lighting: Provide factory-wired, LED vapor-proof luminaires within housing. AC/DC lighting system for operation from engine batteries when AC power source is unavailable.

P. Convenience Outlet: Factory-wired convenience 120v duplex-outlet within enclosure, GFCI.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment for units with a ratings 750kw or below.

1. Material: Standard neoprene separated by steel shims.

B. Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint for units with a rating larger than 750kw.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Minimum Deflection: 0.5.

C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.

B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Test generator, exciter, and voltage regulator as a unit.
3. Full load run.
4. Maximum power.
5. Voltage regulation.
6. Transient and steady-state governing.
7. Single-step load pickup.
8. Safety shutdowns.
9. Report factory test results within 10 days of completion of test.

2.12 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

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

3.02 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service in accordance with requirements indicated:

1. Notify Project Manager in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without written permission.

3.03 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:

1. Install packaged engine generators on cast-in-place concrete equipment bases or steel dunnage as indicated on drawings.
2. Coordinate size and location of mounting bases for packaged engine generators.
3. Install unit with vibration isolation devices described in section 2.10.

3.04 FIELD QUALITY CONTROL

A. Tests and Inspections: The supplier of the electric generating plant and associated items covered herein shall provide factory certified technicians to inspect the completed installation and to perform an initial startup inspection to include:

1. Ensuring the engine starts (both hot and cold) within the specified time.
2. Verification of engine parameters within specification.
3. Verify no load frequency and voltage, adjusting if required.
4. Test all automatic shutdowns of the engine-generator.
5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

B. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

C. Battery and Charger Tests:

1. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions.
2. Verify that measurements are within manufacturer's specifications."

D. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest and reinspect as specified above.

I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

3.06 MAINTENANCE SERVICE

A. Repair Service Capabilities:

1. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including: engines, alternators, control systems, paralleling electronics, and power transfer equipment.
2. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 50 miles of the site.
3. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

B. Preventative Maintenance Service Agreement: The supplier shall include as a line-item adder in the proposal, a one-year maintenance service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine generator set(s) and the transfer switch(es). This

agreement shall include semi-annual preventative maintenance visits to verify operation and/or complete the following:

1. All periodic engine maintenance as recommended by the service manual.
2. All electrical controls maintenance and calibrations as recommended by the manufacturer.
3. All auxiliary equipment as a part of the emergency systems.
4. The supplier shall guarantee emergency service.
5. All expendable maintenance items are to be included in this agreement.
6. A copy of this agreement and a schedule shall be provided in the submittal documents, detailing scope of work and preventative maintenance service visit interval.

END OF SECTION 26 32 13

PART 1 - GENERAL

1.01 SCOPE

Furnish and install automatic transfer switch(es) with number of poles, amperage, voltage, and withstand current ratings as shown on the plans. Basis of design is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch, Open - In Phase Transfer, 1200 A, 3 Pole 4 Wire 208V, Transfer Switch in a NEMA 1 Enclosure. Each automatic transfer shall consist of a mechanically held power transfer switch unit and a microprocessor controller, interconnected to provide complete automatic operation. All transfer switches and control panels shall be the product of the same manufacturer.

1.02 ACCEPTABLE MANUFACTURERS

Automatic transfer switches shall be Generac TX Series.

1.03 CODES AND STANDARDS

The automatic transfer switches and accessories shall conform to the requirements of:

A. UL 1008 - Standard for Automatic Transfer Switches
B. NFPA 70 - National Electrical Code (2017 version and later for start circuit monitoring)
C. NEC Articles 700, 701, 702, 708
D. NFPA 99 – Health Care Facilities
E. NFPA 110 – Emergency and Standby Power Systems
F. IEEE Standard 446 – IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
G. NEMA Standards ICS10, MG1, MG250, ICS6, AB1
H. ANSI C62.41
I. International Standards Organization: ISO 8528, 9001.
J. Where seismic rating and/or certification is required: IBC 2018, OSHPD

PART 2 – PRODUCTS

2.01 MECHANICALLY HELD TRANSFER SWITCH

A. The basis of design is the Generac TX Series Transfer switch that utilities a knife blade mechanically latching design with maintenance free contacts. The transfer switch unit shall be electrically operated and mechanically held. The open transition switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency. The delayed transition switch shall be mechanically interlocked to ensure one of three possible positions, normal and emergency.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. A manual operating handle shall be provided for maintenance purposes.

E. Designs utilizing components of or parts thereof which are not intended for continuous duty, repetitive switching, or transfer between two active power sources are not acceptable.

F. Where neutral conductors must be switched, the ATS shall be provided with fully rated neutral transfer contacts.

G. Where neutral conductors are to be solidly connected, a neutral terminal plate with fully rated AL-CU pressure connectors shall be provided.

H. The switch shall be capable of the following methods of transfer: Open with In-Phase transition only, Time Delay in Neutral transition, or In-Phase transition with a default to Time Delay in Neutral.

I. The transfer switch shall have a Seismic Certification to the requirements of the international Building Code of electrical equipment.

2.02 ATS CONTROL WITH INTEGRATED USER INFERFACE PANEL

A. The basis of design is the Generac TXC-100 Controller with Integrated User Interface Panel which is voltage agnostic for service purposes removing the need for technicians to carry and support control panels for every available voltage.

Any manufacturers that provide a controller or control panel that does not meet this requirement should notify the consulting engineer before bidding.

B. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance.

C. The controller shall direct the operation of the transfer switch. The controller's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and include standard on-board serial communications capability.

D. A user accessible USB port shall be provided to facilitate firmware updates, uploading of switch operational parameters, downloading of event history and switch operational statistics. This USB port shall be front accessible without opening the ATS door.

E. The controller shall provide single and three phase capability for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.1Hz. Time delay settings shall be accurate to ±0.5% of the full-scale value of the time delay. The panel shall be capable of operating over a temperature range of -20 to + 70 degrees C.

F. The controller power supply shall be field-configurable to operate on 120V through 480V systems without the need for transformers.

G. Control logic shall be backed up with a rechargeable, user-replaceable lithium-ion battery that shall also maintain control power for up to 60 minutes in the event no source power is available.

H. The controller shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance.

I. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:

1. IEC 61000 – 4 – 3 Radiated RF Field Immunity
2. IEC 61000 – 4 – 4 Electrical Fast Transient/Burst Immunity
3. IEC 61000 – 4 – 5 Surge Immunity
4. IEC 61000 – 4 – 6 Conducted RF Immunity
5. IEC 61000 – 4 -11 Voltage Dips and Interruptions
6. EN 61000 – 6 - 2 Industrial Immunity Requirements EN 61000-6-4 - Radiated Emissions

7. EN 61000 – 6 - 4 Conducted Emissions
8. CISPR 11 – Conducted RF Emissions and Radiated RF Emissions

2.03 ENCLOSURE

The basis of design is a Generac TX Series Non-Service Entrance Rated Transfer Switch in a NEMA 1 enclosure, with dimensions no larger than 78 Inches in Height, 30 Inches in Width, and 24 Inches In Depth. Larger enclosures than the basis of design will need to be approved by the Consulting Engineer to ensure there is enough wall space and appropriate clearance.

A. Provide a temperature and humidity controlled anti-condensation heater for all NEMA 3R and 4X enclosed units. Heater shall be an available option on NEMA 1 enclosures, when called for on plans. Heater cover to indicate a hot surface.

B. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

C. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

PART 3 - OPERATIONS

3.01 CONTROLLER DISPLAY AND KEYPAD

A. A backlit four-line graphical LCD display and human interface shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the RS-485 communications port.

B. All instructions and controller settings shall be easily accessible, readable, and accomplished without the use of codes, calculations, or instruction manuals.

C. The user interface shall be provided with test/reset modes. The test mode will simulate a normal source failure. The reset mode shall bypass the time delays on either transfer to emergency or retransfer to normal.

D. The following parameters shall only be adjustable only by authorized service personnel:

1. Nominal line voltage and frequency
2. Single or three phase sensing on normal
3. Transfer operating mode configuration, (open transition, or delayed transition)

3.02 VOLTAGE AND FREQUENCY SENSING

A. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout, and trip settings capabilities; values shown as percentage of nominal unless otherwise specified.

Voltage and Frequency Settings	Range	Default Value
Source 1 (Normal) is Genset	Yes or No	No
Source 1 Undervoltage Dropout	50-97%	85%
Source 1 Undervoltage Pickup	52-99%	90%
Source 1 Overvoltage Dropout	105-120%	110%
Source 1 Overvoltage Pickup	103-118%	105%
Source 1 Underfrequency Dropout	90-97%	90%
Source 1 Underfrequency Pickup	91-99%	95%
Source 1 Overfrequency Dropout	103-110%	105%
Source 1 Overfrequency Pickup	101-109%	102%
Source 1 Voltage Imbalance Drop	5-20%	5%
Source 1 Voltage Imbalance Pickup	3-18%	3%
Source 1 Warmup Time	0-1800s	3s
Source 1 Cooldown Time	0-1800s	1800s
Source 1 Minimum Run Time	300-1800s	1200s
Source 2 is Generator	Yes or No	Yes
Source 2 Undervoltage Dropout	50-97%	85%

Source 2 Undervoltage Pickup	52-99%	90%
Source 2 Overvoltage Dropout	105-120%	110%
Source 2 Overvoltage Pickup	103-118%	105%
Source 2 Underfrequency Dropout	90-97%	90%
Source 2 Underfrequency Pickup	91-99%	99%
Source 2 Overfrequency Dropout	103-110%	105%
Source 2 Overfrequency Pickup	101-109%	102%
Source 2 Voltage Imbalance Drop	5-20%	5%
Source 2 Voltage Imbalance Pickup	3-18%	3%
Source 2 Minimum Run Time	300-1800s	1200s
Source 2 Warmup Time	0-1800s	3s
Source 2 Cooldown Time	0-1800s	1800s
Phase Rotation Check	ABC, CBA, OFF	ABC
Supply Overvoltage	350 VAC	Fixed
Manual Return to Normal	Yes or No	
Time Delay Settings		
Transfer to Emergency	120s max	30s
Re-transfer to Normal	1,800s max	1,800s
Time Delay Neutral	120s max	30s
Engine Cool Down	300-1,800s	1,800s
Delayed Transition Time	120s max	120s
Elevator Signal	120s max	30s
In Phase Transfer	Yes or No	
In Phase Synchronization	Time 60-3600s	300s
Preferred Source	S1, S2	S1
Voltage Imbalance Enable	Yes or No	
Voltage Imbalance Timeout	10-30s max	20s

B. Repetitive accuracy of all settings shall be within 1% at +25C.

C. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via RS-485 communications port access.

D. Source status screens shall be provided for both normal & emergency to provide digital readout of voltage and frequency.

E. The backlit graphical display shall have multiple language capability. Languages can be selected from the user interface.

3.03 TIME DELAYS

A. A **Line Interrupt** delay shall be provided to override momentary normal source outages, delay all transfer and engine starting signals; adjustable 0 to 120 seconds. It shall be possible to bypass the time delay from the controller user interface.

B. An **Engine Warm Up** delay shall be provided for extended engine RPM stabilization where fast transfer to the emergency source is not required; adjustable 0 to 1,800 seconds. It shall be possible to bypass the time delay from the controller user interface.

C. A **Transfer to Emergency** delay shall be provided for controlled sequencing of loads to the emergency source; adjustable from 0 to 120 seconds. It shall be possible to bypass the time delay from the controller user interface.

D. A **Retransfer to Normal** delay shall be provided to ensure stability of the normal source, adjustable from 0 to 1,800 seconds. Time delay shall be automatically bypassed if the emergency source fails and normal source is acceptable.

E. An **Engine Minimum Runtime** delay shall be provided to reduce nuisance starts when the normal source power is unstable but does not trigger a transfer to the emergency source, adjustable from 5 to 30 minutes. Operates in conjunction with Engine Cool Down delay.

F. An **Engine Cool Down** delay shall be provided; adjustable 300 – 1,800 seconds.

G. A **Delayed Transition** delay shall be provided to ensure sufficient time for motor voltage decay for transition between live sources; adjustable from 0 – 120 seconds.

H. An **Elevator Signal Before Transfer** output signal shall be provided to drive an external relay for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 120 second delay in any of the following modes:

1. Prior to transfer only.
2. Prior to and after transfer.
3. Normal to emergency only.
4. Emergency to normal only.
5. Normal to emergency and emergency to normal.
6. All transfer conditions or only when both sources are available.

I. For special applications (i.e., three sources), the option to select the **Preferred Source**.

J. All adjustable time delays shall be field adjustable without the use of special tools or software.

Time Delay Summary Table:

Time Delay Description	Range	Default Value
Line Interrupt Delay	0 – 120 sec.	3 sec.
Engine Warm Up Delay	0 – 1,800 sec.	3 sec.
Transfer to Emergency	0 – 120 sec.	3 sec.
Retransfer to Normal	0 – 1,800 sec.	1,800 sec.
Engine Minimum Run Time	5 – 30 min.	5 min.
Engine Cool Down	300 – 1,800 sec.	1,800 sec.
Delayed Transition (Center Off Position)	0 – 120 sec.	120 sec.
Elevator Signal Before Transfer	0 – 120 sec.	0 sec.
Preferred Source	Normal (S1), Emerg. (S2)	Normal (S1)

3.04 EXTERNAL CONTROL INTERFACES AND INDICATORS

A. Communications connectors, user interface and display shall be accessible and usable without presenting an arc-flash hazard.

B. Customer inputs shall be optically isolated for wider compatibility with external systems. This will protect the controller from external surges and transient voltages.

C. Surge Protection for the ATS controls shall be provided.

D. Replaceable fuses to protect the power supply to the ATS control panel.

E. A set of contacts rated 5 amps, 30 VDC shall be provided for a low-voltage **engine start** signal. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output and run for the duration of the

Engine Minimum Runtime setting, regardless of whether the normal source restores before the load is transferred.

F. Engine starting contacts shall facilitate start-circuit monitoring to comply with the 2017 and later versions of NFPA 70 Article 700.10 (D)(3).

G. Two sets of Form-C auxiliary contacts rated 10 amps, 250 VAC shall be provided to indicate the switch actuator position, including center-off for Time Delay Neutral switches or a Permissive (Emergency Inhibit) condition.

H. A single **General Alarm** (summary alarm) indication shall light up the alert indicator and de-energize the configured common alarm output relay for external monitoring.

I. LED indicating lights shall be provided; one to indicate when the ATS is connected to the normal source and one to indicate when the ATS is connected to the emergency source.

J. LED indicating lights shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency source, as determined by the voltage sensing trip and reset settings for each source.

K. LED indicating light shall be provided to indicate switch not in automatic mode (manual).

L. LED indicating light shall be provided to indicate any alarm condition.

M. The controller shall have two programmable inputs and one programmable output as standard; with an optional expansion board to add up to four programmable input/outputs. Programmable I/O conditions shall include:

Programmable Output	Programmable Input
Source 1 – Two Wire Start	Permissive (Emergency Inhibit)
Source 2 – Two Wire Start	Remote Engine Fast Test
Engine Exercising	Remote Engine Normal Test
Engine Warmup	ATS Timer
Signal Before Transfer	Initiate Demand Response
General Alarm	
Source 1 Good	
Source 2 Good	

N. System Status - The controller LCD display shall include a System Status screen which shall be accessible from any point in the menu system by depressing the "ESC" key until you arrive at the System Status screen. This screen shall display

a clear description of the active operating sequences and switch position. Operational status information displayed shall include:

1. Source 1 status (good or bad)
2. Source 2 status (good or bad)
3. Any active timer
4. Permissive (Emergency Inhibit when active)

3.05 TRANSFER AND EXERCISE CONTROLS

The following standard features shall be built into the controller, capable of being activated through keypad programming as required by the user:

A. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.

B. An engine generator exercising timer shall be provided to configure daily, day of week, weekly, bi-weekly, or monthly testing of an engine generator set at a specified time of day with or without load for a programmable period (Engine Minimum Runtime).

C. Terminals shall be provided for a remote contact to signal the ATS to transfer to emergency for remote test. Test signal can be enabled through the keypad or digital input. Transfer to emergency for demand response can be enabled by digital input.

D. **For In-Phase Transfer Switch Designs:** An in-phase monitor shall be provided in the controller such that the transfer occurs with less than ten degrees phase angle difference between sources. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents and shall not require external control of power sources. In-phase switch transfer time shall not exceed 25ms.

E. **For Delayed Transition Transfer Switch Designs:** Terminals shall be provided for a remote contact to signal the ATS to load-shed (Permissive is removed) and move to a center-off position. When the load-shed signal is removed (Permissive is restored), the ATS shall reclose to the emergency. If normal source is good during load-shed the ATS shall transfer to and remain on normal source.

3.06 DATA LOGGING AND DIAGNOSTICS

Controllers that require multiple screens to determine system status or display "coded" system status messages, which must be explained by references in the operator's manual are not permissible.

A. Controller & Contactor Health Monitoring with visual and auxiliary contact status shall be provided.

B. Communications Interface – The controller shall be capable of interfacing, through a standard RS-485 serial communication port with a network of transfer switches.

C. Data Logging – The controller shall have the ability to log data and to maintain the last 200 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:

1. Date, time and reason for transfer normal to emergency.
2. Date, time and reason for transfer emergency to normal.
3. Date, time and reason for engine start.
4. Date and time engine stopped.
5. Date and time emergency source available.
6. Date and time emergency source not available.

PART 4 - ADDITIONAL FEATURES AND ACCESSORIES

4.01 ADDITIONAL OPTIONAL

A. Line Interrupt Time Delay. - Not Selected

B. Integrating Metering with current transformer. - Not Selected

C. Manual Retransfer to Generator. - Not Selected

D. Permissive (Emergency Inhibit). - Not Selected

E. Chicago Toolkit. - Not Selected

F. Expanded Input/Output Module. - Not Selected

G. Pad Lockable Control. - Not Selected

H. Temperature and Humidity Controlled Heater for NEMA1. - Not Selected

I. Transient Voltage Surge Suppressor (TVSS). - Not Selected

PART 5 - ADDITIONAL REQUIREMENTS

5.01 WITHSTAND AND CLOSING RATINGS

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals with the type of overcurrent protection shown on the plans. The basis of design for this project is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch with a 100ka 3 Cycle Rating, 100ka (.05 seconds) Time Based Rating, and a 125ka Specific Breaker Rating transfer switches from other manufacturers with ratings less than provided in this section will need to be approved by the Consulting Engineer to ensure compatibility with the project.

B. Provide a temperature and humidity controlled anti-condensation heater for all NEMA 3R and 4X enclosed units. Heater shall be an available option on NEMA 1 enclosures, when called for on plans. Heater cover to indicate a hot surface.

C. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

D. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

5.02 TESTS AND CERTIFICATIONS

A. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency, and time delay settings are in compliance with the specification requirements.

B. The ATS manufacturer shall be certified to ISO 9001: 2015 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation, and servicing in accordance with ISO 9001: 2015.

5.03 SERVICE REPRESENTATION

A. The ATS manufacturer shall support a service organization of company-employed personnel located throughout the contiguous United States. The service center's

personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 10 years.

5.04 WARRANTY

A. The basis of design is a Generac TX Series Non-Service Entrance Rated Automatic Transfer Switch Basic 2 Year Warranty.

B. A Basic Warranty is defined as the manufacturer covering replacement parts for the listed amount of the warranty period.

C. The Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period.

D. The switch mechanism and controller shall be easily removable from the enclosure in the field. This requirement will facilitate easy single-person installation on wall mounted switches, conduit fitting, and cable pulling while minimizing risk of damage and/or contamination of ATS components during the installation process.

E. Controller human interface and USB port shall be visible and operational through the enclosure door, without the need for personal protective equipment, avoiding arc-flash hazard for routine checks of the controller status.

END OF SECTION 26 36 23

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.03 EMERGENCY LED POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
   1. Emergency Connection: Operate LED'S continuously as indicated on plans at an output equal to the specified emergency driver for the wattage specified. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture driver.
   2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   3. Battery: Sealed, maintenance-free, nickel-cadmium type.
   4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
   5. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals.

2.04 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.05 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
    1. Battery: Sealed, maintenance-free, lead-acid type.
    2. Charger: Fully automatic, solid-state type with sealed transfer relay.
    3 Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
    7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

2.06 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.02 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

END OF SECTION 26 51 00

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior luminaires with lamps and ballasts.
   2. Luminaire-mounted photoelectric relays.

1.02 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.

B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.02 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

F. Exposed Hardware Material: Stainless steel.

G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

I. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

K. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

L. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected from manufacturer's standard catalog of colors.

2.03 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
   1. Relay with locking-type receptacle shall comply with ANSI C136.10.
   2. Adjustable window slide for adjusting on-off set points.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.02 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

END OF SECTION 26 56 00

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Through-penetration firestopping in fire rated construction.
   2. Through penetration smoke-stopping in smoke partitions.

B. Scope:
   The scope of the work shall include the conduits, wireways, bus duct, and other electrical raceways installed by the contractor.

1.02 REFERENCES

A. Underwriters Laboratories
   1. U.L. Fire Resistant Directory
      a. Through-penetration firestop devices (XHCR)
      b. Fire resistance ratings (BXUV)
      c. Through-penetration firestop systems (XHEZ)
      d. Fill, void, or cavity material (XHHW)

B. American Society for Testing and Materials Standards:
   1. ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.

1.03 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. System: Specific products and applications, classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

F. Sleeve: Metal fabrication or pipe section extending through thickness off barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other sections and may or may not be required.

1.04 SYSTEM DESCRIPTION

A. Design Requirements
   1. Fire-rated construction: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.
   2. Smoke barrier construction: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

1.05 SUBMITTALS

A. Submit in accordance with general conditions unless otherwise indicated.

B. Product data: Manufacturer's specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.

C. Shop drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Details of each proposed assembly identifying intended products and applicable UL System number, or UL classified devices.
   2. Manufacturer or manufacturers representative shall provide qualified engineering judgements and drawings relating to non-standard applications as needed.

D. Quality control submittals:
   1. Statement of qualifications.

E. Applicators' qualifications statement:
   1. List past projects indicating required experience.

1.06 QUALITY ASSURANCE

A. Installer's qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this project, plus the following:
   1. Acceptable to or licensed by manufacturer, State or local authority where applicable.
   2. At least 2 years experience with systems.
   3. Successfully completed at least 5 comparable scale projects using this system.

B. Local and State regulatory requirements: Submit forms or acceptance for proposed assemblies not conforming to specific UL Firestop System numbers, or UL classified devices.

C. Materials shall have been tested to provide fire rating at least equal to that of the construction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:
   1. Deliver products in original unopened packaging with legible manufacturer's identification.
   2. Coordinate delivery with scheduled installation date, allow minimum storage at site.

B. Storage and protection: Store materials in a clean, dry, ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instruction.

1.08 PROJECT CONDITIONS

A. Existing conditions:
   1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
   2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

B. Environmental requirements:
   1. Furnish adequate ventilation if using solvent.
   2. Furnish forced air ventilation during installation if required by manufacturer.
   3. Keep flammable materials away from sparks or flame.
   4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

1.09 GUARANTEE

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, co-adhesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from date of substantial completion.

PART 2 - PRODUCTS

2.01 THROUGH-PENETRATION FIRESTOPPING OF FIRE-RATED CONSTRUCTION

A. Systems or devices listed in the U.L. Fire Resistance Director under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the U.L. system or device, and designed to perform this function.
2. Acceptable manufacturers and products.
   a. Those listed in the U.L. Fire Resistance directory for the U.L. System involved and as further defined in Part 3.06 of this section.
3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer.
4. Products shall be 3M firestopping products and systems or equal.

2.02 SMOKE-STOPPING AT SMOKE PARTITIONS

A. Through-penetration smoke-stopping: Any system complying with the requirements for through-penetration firestopping in fire-rated construction, as specified in Part 3.06 of this section, is acceptable, provided that the system includes the specified smoke seal or will provide a smoke seal. The length of time of the fire resistance may be disregarded.

2.03 ACCESSORIES

A. Fill, void or cavity materials: As classified under category XHHW in the U.L. Fire Resistance Directory.

B. Forming materials: As classified under Category XHKU in the U.L. Fire Resistance Directory.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Verify barrier penetrations are properly sized and in suitable condition for application of materials.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.03 INSTALLATION

A. Install penetration seal materials in accordance with printed instructions of the U.L. Fire Resistance Directory and in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.

C. Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

D. Protect materials from damage on surfaces subject to traffic.

E. Place firestopping in annular space around fire dampers before installation of damper's anchoring flanges which are installed in accordance with fire damper manufacturers recommendations.

F. Where large openings are created in walls or floors to permit installation of pipes, ducts, cable tray, bus duct or other items, close unused portions of opening with firestopping material tested for the application. See U.L. Fire Resistance Directory and Section 3.06 of this document.

G. Install smoke stopping as specified for firestopping.

3.04 FIELD QUALITY CONTROL

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

3.05 ADJUSTING AND CLEANING

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.06 SYSTEMS AND APPLICATION

A. The installation shall be as required by manufacturer for type of construction, Type of U.L. systems, type of penetration, and type of fire stopping system

END OF SECTION 26 99 00

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Surface pathways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

B. Related Requirements:
1. Section 26 05 33 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.

1.02 ACTION SUBMITTALS

A. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Sustainable Design Submittals:

C. Shop Drawings: For custom enclosures and cabinets.

PART 2 - PRODUCTS

2.01 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. EMT: Comply with ANSI C80.3 and UL 797.

D. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:
a. Material: Steel or die cast.
b. Type: compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

E. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.02 NONMETALLIC CONDUITS AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Continuous HDPE: Comply with UL 651B.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

E. Solvents and Adhesives: As recommended by conduit manufacturer.

2.03 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish.

C. Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets:
1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet-Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

E. Metal Floor Boxes:
   1. Material: Cast metal.
   2. Type: Fully adjustable.
   3. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.
   1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

J. Gangable boxes are prohibited.

K. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic or fiberglass.
   3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:
   1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
   2. Hinged door in front cover with flush latch and concealed hinge.
   3. Key latch to match panelboards.
   4. Metal barriers to separate wiring of different systems and voltage.
   5. Accessory feet where required for freestanding equipment.
   6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Pathways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
   2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

H. Stub-ups to Above Recessed Ceilings:
   1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

I. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

K. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

M. Spare Pathways: Install pull wires in empty pathways. Cap underground pathways designated as spare above grade alongside pathways in use.

N. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.

O. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound.

P. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

Q. Mount boxes at heights indicated on Drawings in accordance with ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

R. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

3.02 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Section "Earth Moving."
3. After installing conduit, backfill and compact. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section "Earth Moving."
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
   b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.03 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.04 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

END OF SECTION 27 05 28

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Category 6 twisted pair cable.
   2. Twisted pair cable hardware, including plugs and jacks.
   3. Grounding provisions for twisted pair cable.

1.02 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
   1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
   2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft., and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration Drawings and printouts.
   4. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment.

C. Twisted pair cable testing plan.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer**,** installation supervisor, and field inspector.

B. Product Certificates: For each type of product.

C. Source quality-control reports.

D. Field quality-control reports.

1.05 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.02 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
   1. Communications, Plenum Rated: Type CMP complying with UL 1685
   2. Communications, Non-plenum: Type CMP or Type CMR in listed plenum or riser communications raceway.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.03 CATEGORY 6 TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100-ohm, 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP)]

E. Cable Rating: Plenum.

F. Jacket: Blue thermoplastic.

2.04 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:
   1. Comply with the performance requirements of Category 6 or Category 6a.
   2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
   3. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks:
   1. 110-style IDC for Category 6.
   2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

D. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
   1. Features:
      a. Universal T568A and T568B wiring labels.
      b. Labeling areas adjacent to conductors.
      c. 24 or 48 ports.
   2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.

E. Plugs and Plug Assemblies:
   1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
   2. Standard: Comply with TIA-568-C.2.

F. Jacks and Jack Assemblies:
   1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.

2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.

G. Faceplate:
1. Two or Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
3. Metal Faceplate: Stainless steel complying with requirements in Section 262726 "Wiring Devices."
4. For use with snap-in jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

H. Legend:
1. Machine printed, in the field, using adhesive-tape label.

2.05 GROUNDING

A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

PART 3 - EXECUTION

3.01 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.
1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

D. General Requirements for Cabling:
1. Comply with TIA-568-C.1.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.

5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

E. Group connecting hardware for cables into separate logical fields.

F. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

3.02 FIRESTOPPING

A. Comply with requirements in Section 26 99 00 "Fireproofing Materials and Methods."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.03 GROUNDING

A. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

B. Comply with TIA-607-B and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

D. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.04 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Equipment grounding conductors.

C. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
   4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.
      a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
      b. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

D. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:
   1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.05 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Visually inspect twisted pair cabling jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 27 15 13

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PART 1 - GENERAL

1.01 DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire detection equipment required to form a complete, operative, coordinated system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, Fire Alarm Control Panel (FACP), auxiliary control devices, annunciators, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
   1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 24 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.

C. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for Auxiliary Protected Premises Signaling Systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software-directed polling of field devices.
   1. The Secondary Power Source of the fire alarm control panel will be capable of providing at least 60 hours of backup power with the ability to sustain 5 minutes in alarm at the end of the backup period.
   2. The Secondary Power Source installed in a system backed up by a generator need to supply 4 hours of backup power.

D. The fire alarm system shall be manufactured by an by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

E. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

F. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

   UL 38 Manually Actuated Signaling Boxes
   UL 217 Smoke Detectors, Single and Multiple Station
   UL 228 Door Closers–Holders for Fire Protective Signaling Systems
   UL 268 Smoke Detectors for Fire Protective Signaling Systems

UL 268A Smoke Detectors for Duct Applications
UL 346 Waterflow Indicators for Fire Protective Signaling Systems
UL 464 Audible Signaling Appliances
UL 521 Heat Detectors for Fire Protective Signaling Systems
UL 864 Standard for Control Units for Fire Protective Signaling Systems
UL 1481 Power Supplies for Fire Protective Signaling Systems
UL 1610 Central Station Burglar Alarm Units
UL 2075 Standard for Gas and Vapor Detectors and Sensors
UL 1638 Visual Signaling Appliances
UL 1971 Signaling Devices for Hearing Impaired
UL 2017 General-Purpose Signaling Devices and System

G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.02 SCOPE:

A. An intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance:
1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC), NFPA Style 6 (Class A) or NFPA 7 (Class A) Signaling Line Circuits (SLC).
2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y) or Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. All circuits shall be power-limited, UL864 Ninth edition requirements.
5. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
6. Alarm signals arriving at the main FACP shall not be lost following a primary power failure or outage of any kind until the alarm signal is processed and recorded.
7. Panel shall meet requirement of UL 864 10th Edition

C. BASIC SYSTEM FUNCTIONAL OPERATION
1. When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
   a. The system alarm LED on the system display shall flash.
   b. A local piezo electric signal in the control panel shall sound.
   c. A backlit 80-character LCD display on the FACP shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
   d. In response to a fire alarm condition, the system will process all control

programming and activate all system outputs (alarm notification appliances and/or relays) associated with the point(s) in alarm. Additionally, the system shall send events to a central alarm supervising station via either dial-up over PSTN, IP, Cellular, Internet, Intranet via PSDN or virtual private network.

1.03 SUBMITTALS

A. General:
   1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
   2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.
   3. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.

B. Shop Drawings:
   1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
   2. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
   3. Show annunciator layout, configurations, and terminations.

C. Manuals:
   1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets.
   2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
   3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.

D. Software Modifications:
   1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 4 hours.
   2. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.
   3. Provide firmware updates through USB thumb drive.

E. Certifications:
   1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.04 GUARANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

1.05 POST CONTRACT MAINTENANCE

A. Maintenance and testing shall be on a semi-annual schedule or as required by the local AHJ. A preventive maintenance schedule shall be provided by the contractor describing the protocol for preventive maintenance. The schedule shall include:
   1. Systematic examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
   2. Each circuit in the fire alarm system shall be tested semiannually.
   3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 10.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, tests, and repairs described below. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.06 POST CONTRACT EXPANSIONS

A. The contractor shall have the ability to provide parts and labor to expand the system specified, if so requested, for a period of five (5) years from the date of acceptance.

B. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, CO detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules, and addressable control modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

C. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and

labor necessary to install this hardware.

D. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

E. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.07 APPLICABLE STANDARDS AND SPECIFICATIONS

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:
1. No. 13 Sprinkler Systems
2. No. 70 National Electric Code (NEC)
3. No. 72 National Fire Alarm Code
4. No. 101 Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:
1. No. 38 Manually Actuated Signaling Boxes
2. No. 50 Cabinets and Boxes
3. No. 217 Smoke Detectors, Single and Multiple Station
4. No. 228 Door Closers–Holders for Fire Protective Signaling Systems
5. No. 864 Control Units for Fire Protective Signaling Systems
6. No. 268 Smoke Detectors for Fire Protective Signaling Systems
7. No. 268A Smoke Detectors for Duct Applications
8. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
9. No. 464 Audible Signaling Appliances
10. No. 521 Heat Detectors for Fire Protective Signaling Systems
11. No. 1971 Visual Notification Appliances
12. No. 1610 Central Station Burglar Alarm Units
13. No. 1638 Visual Signaling Appliances
14. No. 2017 General-Purpose Signaling Devices and Systems

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.08 APPROVALS

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
1. UL Underwriters Laboratories Inc
3. FM Factory Mutual
4. NYFD New York Fire Department

5. CSFM California State Fire Marshal

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIAL, GENERAL

A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the National Fire Alarm Code.

B. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

C. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.

D. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.02 CONDUIT AND WIRE

A. Conduit:
1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
2. Where required, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per NEC Article 760-29.
4. With the exception of telephone connections, wiring for 24 volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4-inch (19.1 mm) minimum.

B. Wire:
1. All fire alarm system wiring shall be new.

2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire detection system. Number and size of conductors shall be as recommended by the fire detection system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits, Signaling Line Circuits and Notification Appliance Circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.
6. All field wiring shall be electrically supervised for open circuit and ground fault.
7. The fire alarm control panel shall be capable of T-tapping Class B (NFPA Style 4) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the amount of T-taps, length of T-taps etc., is not acceptable.

C. Terminal Boxes, Junction Boxes and Cabinets:
1. All boxes and cabinets shall be UL listed for their use and purpose.

D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

E. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

2.03 MAIN FIRE ALARM CONTROL PANEL

A. The FACP shall be a Fire Warden model 100-2 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, digital dialer and other system controlled devices. Ethernet Communicators and other system controlled devices. Ethernet communications shall be via a IPOTs card.

B. Operator Control
1. Acknowledge Switch:
a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.

b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

2. Alarm Silence Switch:
   a. Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
3. Alarm Activate (Drill) Switch:
   a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
4. System Reset Switch
   a. Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
5. Lamp Test:
   a. The System RESET switch shall also function as a Lamp Test switch shall activate all system LEDs and light each segment of the liquid crystal display.
6. Programmable Buttons:
   a. The system should have at a minimum 4 programmable function keys for quick zone and NAC disable during maintenance.

C. System Capacity and General Operation
1. The control panel shall provide, or be capable of, expansion to 198 intelligent/addressable devices.
2. The control panel shall include two Form-C programmable relays which can be used for Alarm, Supervisory, and a fixed Trouble relay rated at a minimum of 2.0 amps @ 30 VDC and 0.5 amps @ 30 VAC.
3. It shall also include two programmable Notification Appliance Circuits (NACs) capable of being wired as Class B (NFPA Style Y) or Class A (NFPA Style Z).
4. The fire alarm control panel shall include an operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color-coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire alarm system.
5. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes. The control unit will support the ability to upgrade its operating program using FLASH memory technology. The unit shall provide the user with the ability to program from either the included keypad, or a USB drive programmed from a computer running upload/download program utility.
6. The system shall allow the programming of any input to activate any output or group of outputs. Systems which have limited programming (such as general

alarm), have complicated programming (such as a diode matrix), or REQUIRE a laptop personal computer are not considered suitable substitutes.

7. The FACP shall provide the following features:
   a. Drift compensation to extend detector accuracy during the accumulation of dust and foreign material.
   b. Detector sensitivity test, meeting requirements of NFPA 72, Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
   c. The ability to display or print system reports.
   d. Alarm verification. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification an excessive number of times.
   e. Positive Alarm Sequence (PAS presignal), meeting NFPA 72 requirements.
   f. Rapid manual station reporting.
   g. Non-alarm points for general (non-fire) control.
   h. Periodic detector test, conducted automatically by the software.
   i. Walk test, with a check for two detectors set to same address.
   j. Universal end of line resistor for NACs and remote sync output
   k. Temporal-4 NAC coding for CO alarms.
   l. Built in Class-A capability for all 4 NACs.
   m. Local upload/download using USB drive.
   n. Flash firmware with USB thumb drive.
8. The FACP shall be capable of coding Notification Appliance Circuits in March Time Code (120 PPM), Temporal (NFPA 72) for fire alarm and CO alarm, and California Code. Main panel notification circuits (NACs 1, 2, & 4) shall also automatically synchronize and be programmable for any of the following manufacturer's notification appliances connected to them: System Sensor, Wheelock, or Gentex with no need for additional synchronization modules.

D. Central Processing Unit
1. The microprocessor shall be a state-of-the-art; high speed device and it shall communicate with, monitor and control all external interfaces. It shall include hardware for system program storage, non-volatile memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The microprocessor shall contain and execute all specific actions to be taken in the condition of an alarm. Control programming shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file.
4. A special program check function shall be provided to detect common operator errors.
5. An auto-programming capability (self-learn) shall be provided to quickly identify devices connected on the SLC and make the system operational.
6. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program

the system with batch upload/download. This program shall also have a verification utility which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

E. Display

1. The display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
3. The display shall contain an alphanumeric, text-type display and dedicated LEDs for the annunciation of AC POWER, FIRE ALARM, SUPERVISORY, TROUBLE, ALARM SILENCED and CO Alarm conditions.
4. The display keypad shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
5. The display shall include the following operator control switches: ACKNOWLEDGE/STEP, ALARM SILENCE, DRILL (alarm activate), and SYSTEM RESET.

F. Signaling Line Circuit (SLC)

1. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (ionization, photoelectric or thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The CPU shall receive information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm or trouble conditions exist for each detector. The software shall automatically compensate for the accumulation of dust in each detector up to allowable limits. The information shall also be used for automatic detector testing and for the determination of detector maintenance conditions.
3. The detector software shall meet NFPA 72 requirements and be certified by UL as a calibrated sensitivity test instrument.

G. Serial Interfaces

1. The system shall provide a means of interfacing to UL Listed Electronic Data Processing (EDP) peripherals using the EIA-232 communications standard.
2. An annunciator RS-485 (ANN-Bus) bus shall be used to connect an UL-Listed 80-column printer anywhere within the 6,000 range of the serial bus connection. The printer shall communicate with the control panel using an RS-485 converter/interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz. The interface shall contain both a 9-pin serial and standard centronics parallel connector. Either shall be capable of connection to a serial or parallel printer. The bus shall also provide

connection to additional addressable modules supporting remote 80 character LCD text annunciators that mimic the standard panel display and controls. Said annunciators shall support remote acknowledge, silence, drill and reset functions and shall be enabled via a keyswitch. The bus shall also provide connection to addressable modules supporting up to 40 LEDs for use with a graphic annunciator. The bus shall also provide connection to programmable relay modules. The bus shall also provide connection to addressable LED annunciators.

H. The control panel will have the capability of Reverse Polarity Transmission or connection to a Municipal Box for compliance with applicable NFPA standards.

I. Internet Protocol Over Telephone Service (IPOTS) is an interface for communicating digital information between a fire alarm control panel and a UL-Listed central station. The IPOTs module is capable of transmitting contact ID formatted alarms to a central station equipped with a compatible IP receiver via Ethernet over a private or public WAN/LAN, Intranet or Ethernet.
   1. The IPOTS communicator shall be an integral module component of the fire alarm control panel enclosure.
   2. The IPOTS communicator shall be completely field-programmable locally from a USB port or via Ethernet,Telnet and through AlarmNet.
   3. The IPOTS communicator shall be capable of transmitting events in contact ID format.
   4. Communication shall include vital system status such as:
      a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
      b. Independent Addressable Device Status
      c. AC (Mains) Power Loss
      d. Low Battery and Earth Fault
      e. System Off Normal
      f. 12 and 24 Hour Test Signal
      g. Abnormal Test Signal (per UL requirements)
      h. EIA-485 Communications Failure
      i. IP Line Failure
   5. The IPOTS communicator shall support independent zone/point reporting. In this format, the IPOTS shall support the transmission of addressable points within the system. This format shall enable the central station to have exact details concerning the location of the fire for emergency response. The communication over IP / cellular shall be transparent to the panels normal operation over phone lines.
   6. The IPOTS communicator shall utilize a supervisory heart beat signal of no less than once every 90 seconds insuring multiplexed level line supervision. Loss of Internet or Intranet connectivity shall be reported in no more than 200 seconds. This IPOTS communicator can also can program communication in supervisor according to all NFPA guidelines. Alarm events shall be transmitted to a central station in no less than 90 seconds from time of initiation to time of notification.

J. Enclosures:
   1. The control panel shall be housed in a UL-listed cabinet suitable for surface mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and painted (red or black) via manufacturer's standard finish.

2. The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.
3. The door shall provide a key lock and shall provide for the viewing of all indicators.
4. The cabinet shall accept a chassis containing the PCB and to assist in quick replacement of all the electronics including power supply shall require no more than two bolts to secure the panel to the enclosure back box.
5. The cabinet shall also support a mechanical secured optional dress panel limiting access to the internals of the panel.

K. Field Charging Power Supply (FCPS)
1. The FCPS-24S6/8 is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
2. The FCPS-24S8 shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge up to 18.0 amp hour batteries and to support 60 hour standby. The FCPS-24S8 shall offer up to 8.0 amps (6.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge up to 18.0 amp hour batteries and to support 60 hour standby.
3. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (Style Y or Z) shall be available for connection to the Notification devices.
4. The FCPS shall optionally provide synchronization of all connected strobes or horn strobe combinations when System Sensor, Wheelock or Gentex devices are installed.
7. The FCPS shall function as a sync follower as well as a sync generator.
5. The Field Charging Power Supply shall include an attractive surface mount back box.
6. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
7. The Field Charging Power Supply includes power limited circuitry, per UL standards.
8. The Field Charging Power Supply shall use the same key type as the fire alarm control panel and fire command center.

L. Power Supply:
1. The main power supply for the fire alarm control panel shall provide 3.0 amps of available power for the control panel and peripheral devices. The main power supply power can be expanded to 6.0 amps with the addition of a expansion transformer
2. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
3. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger or may be used with an external battery and charger systems. Battery arrangement may be configured in the field.
4. The main power supply shall continuously monitor all field wires for earth ground

conditions.

5. The main power supply shall operate on either 120VAC, 60 Hz or 240 VAC, 60 Hz and shall provide all necessary power for the FACP.

2.04 SYSTEM COMPONENTS

A. Programmable Electronic Sounders:
   1. Electronic sounders shall operate on 24 VDC nominal.
   2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 feet from the device.
   3. Shall be flush or surface mounted as shown on plans.

B. Strobe lights shall meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:
   1. The maximum pulse duration shall be 2/10 of one second.
   2. Strobe intensity shall meet the requirements of UL 1971.
   3. The flash rate shall meet the requirements of UL 1971.

C. Audible/Visual Combination Devices:
   1. Shall meet the applicable requirements of Section A listed above for audibility.
   2. Shall meet the requirements of Section B listed above for visibility.

D. Manual Fire Alarm Stations
   1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
   2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
   3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
   4. Manual stations shall be constructed of high impact Lexan, with operating instructions provided on the cover. The word FIRE shall appear on the manual station in letters one half inch (12.7 mm) in size or larger.

E. Conventional Photoelectric Area Smoke Detectors
   1. Photoelectric smoke detectors shall be a 24 VDC, two wire, ceiling-mounted, light scattering type using an LED light source.
   2. Each detector shall contain a remote LED output and a built-in test switch.
   3. Detector shall be provided on a twist-lock base.
   4. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
   5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall flash at least every 10 seconds, indicating that power is applied to the detector.
   6. The detector shall not go into alarm when exposed to air velocities of up to 3000 feet (914.4 m) per minute.

7. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
8. All field wire connections shall be made to the base through the use of a clamping plate and screw.

F. Conventional Ionization Type Area Smoke Detectors
1. Ionization type smoke detectors shall be a two wire, 24 VDC type using a dual unipolar chamber.
2. Each detector shall contain a remote LED output and a built-in test switch.
3. Detector shall be provided on a twist-lock base.
4. It shall be possible to perform a calibration sensitivity and performance test on the detector without the need for the generation of smoke.
5. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs) over 360 degrees, on the detector, which may be seen from ground level. This LED shall flash every 10 seconds, indicating that power is applied to the detector.
6. The detector shall not alarm when exposed to air velocities of up to 1,200 feet (365.76 m) per minute. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
7. All field wire connections shall be made to the base through the use of a clamping plate and screw.

G. Duct Smoke Detectors
1. Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes.

H. Projected Beam Detectors
1. The projected beam type shall be a 4-wire 24 VDC device.
2. The detector shall be listed to UL 268 and shall consist of a separate transmitter and receiver capable of being powered separately or together.
3. The detector shall operate in either a short range (30' - 100') or long range (100' - 330') mode.
4. The temperature range of the device shall be -22 degrees F to 131 degrees F.
5. The detector shall feature a bank of four alignment LEDs on both the receiver and the transmitter that are used to ensure proper alignment of unit without special tools.
6. Beam detectors shall feature automatic gain control which will compensate for gradual signal deterioration from dirt accumulation on lenses.
7. The unit shall be both ceiling and wall mountable.
8. The detector shall have the ability to be tested using calibrated test filters or magnet activated remote test station.

I. OSID Detection
1. Open-area Smoke Imaging Detector shall be an available option. The OSID projected beam detector shall use UV (ultraviolet) and IR (infrared) technology to detect the presence of smoke, while providing nuisance alarm rejection.

2. The detector shall use an imager to measure the level of smoke based on the readings between the emitters and the imager, up to 7 emitters shall be supported.
3. The detector shall operate from 24 VDC
4. The detector shall be able to provide up to 80 degree wide viewing angle
5. The detector shall provide selectable alarm thresholds
6. The detector shall provide alarm and trouble relays used to activate a fire alarm control panel.

J. Aspirating Detection
1. An optional air aspiration detection system shall be available.
2. The aspirating system shall support multiple sensitivity settings.
3. The aspirating system shall operate from 24 VDC.
4. The aspirating system shall provide alarm and trouble relays used to activate a fire alarm control panel.

K. Automatic Conventional Heat Detectors
1. Automatic heat detectors shall have a combination rate of rise and fixed temperature rated at 135 degrees Fahrenheit (57.2 Celsius) for areas where ambient temperatures do not exceed 100 degrees (37.7 Celsius), and 200 degrees (93.33 Celsius) for areas where the temperature does not exceed 150 degrees (65.5 Celsius).
2. Automatic heat detectors shall be a low profile, ceiling mount type with positive indication of activation.
3. The rate of rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory calibrated, moisture-proof, trouble free vent, and shall operate when the rate of temperature rise exceeds 15 degrees F (9.4 degrees C) per minute.
4. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft.
5. Automatic heat detectors shall have a smooth ceiling rating of 2500 square feet (762 square meters).

L. Waterflow Indicator:
1. Waterflow Switches shall be an integral, mechanical, non-coded, non-accumulative retard type.
2. Waterflow Switches shall have an alarm transmission delay time which is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds.
3. All waterflow switches shall come from a single manufacturer and series.
4. Waterflow switches shall be provided and connected under this section but installed by the mechanical contractor.
5. Where possible, locate waterflow switches a minimum of one (1) foot from a fitting which changes the direction of the flow and a minimum of three (3) feet from a valve.

M. Sprinkler and Standpipe Valve Supervisory Switches:
1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.

2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
3. The switch shall be mounted so as not to interfere with the normal operation of the valve and adjusted to operate within two revolutions toward the closed position of the valve control, or when the stem has moved no more than one-fifth of the distance from its normal position.
4. The supervisory switch shall be contained in a weatherproof aluminum housing, which shall provide a 3/4 inch (19 mm) conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The switch housing shall be finished in red baked enamel.
6. The entire installed assembly shall be tamper proof and arranged to cause a switch operation if the housing cover is removed, or if the unit is removed from its mounting.
7. Valve supervisory switches shall be provided and connected under this section and installed by mechanical contractor.

N. Specific System Operations
1. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently programmed for verification of alarm signals. The alarm verification time period shall not exceed 2 minutes.
2. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.
3. Point Read: The system shall be able to display the following point status diagnostic functions:
   a. Device status
   b. Device type
   c. Custom device label
   d. Device zone assignments
4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 500 events. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety.
   a. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel.

The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.

8. The fire alarm control panel shall include Silent and Audible Walk Test functions - Silent and Audible. It shall include the ability to test initiating device circuits and Notification Appliance Circuits from the field without returning to the panel to reset the system. The operation shall be as follows:
    a. The Silent Walk Test will not sound NACs but will store the Walk Test information in History for later viewing.
    b. Alarming an initiating device shall activate programmed outputs, which are selected to participate in Walk Test.
    c. Introducing a trouble into the initiating device shall activate the programmed outputs.
    d. Walk Test shall be selectable on a per device/circuit basis. All devices and circuits which are not selected for Walk Test shall continue to provide fire protection and if an alarm is detected, will exit Walk Test and activate all programmed alarm functions.
    e. All devices tested in walk test shall be recorded in the history buffer.
9. Waterflow Operation
    a. An alarm from a waterflow detection device shall activate the appropriate alarm message on the control panel display; turn on all programmed Notification Appliance Circuits and shall not be affected by the Signal Silence switch.
10. Supervisory Operation
    a. An alarm from a supervisory device shall cause the appropriate indication on the control panel display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
11. Signal Silence Operation
    a. The FACP shall have the ability to program each output circuit (notification circuit or relay) to deactivate upon depression of the Signal Silence switch.
12. Non-Alarm Input Operation
    a. Any addressable initiating device in the system may be used as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

2.05 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General
    1. Addressable devices shall employ the simple-to-set decade addressing scheme. Addressable devices which use a binary-coded address setting method, such as a DIP switch, are not an allowable substitute.
    2. Detectors shall be addressable and intelligent, and shall connect with two wires to the fire alarm control panel signaling line circuits.
    3. Addressable smoke and thermal (heat) detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control

panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.

4. Detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a base with a built-in (local) sounder rated for a minimum of 85 DBA, a relay base and an isolator base designed for Style 7 applications.
5. Detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel.
6. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL, CO). Detectors shall provide address-setting means using decimal switches.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. The detectors shall be ceiling-mounted and available in an alternate model with an integral fixed 135-degree heat-sensing element.
3. Each detector shall contain a remote LED output and a built-in test switch.
4. Detector shall be provided on a twist-lock base.
5. It shall be possible to perform a calibrated sensitivity and performance test on the detector without the need for the generation of smoke. The test method shall test all detector circuits.
6. A visual indication of an alarm shall be provided by dual latching Light Emitting Diodes (LEDs), on the detector, which may be seen from ground level over 360 degrees. These LEDs shall periodically flash to indicate that the detector is in communication with the control panel.
7. The detector shall not go into alarm when exposed to air velocities of up to 1500 feet per minute (fpm).
8. The detector screen and cover assembly shall be easily removable for field cleaning of the detector chamber.
9. All field wire connections shall be made to the base through the use of a clamping

plate and screw.

D. Intelligent Multi-Sensing Detector
1. The intelligent multi-sensing detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal to provide a quick response in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

E. Projected Addressable Beam Detector
1. The projected beam type shall be a 4-wire 24 VDC intelligent, addressable projected beam smoke detector device.
2. The detector shall be listed to UL 268 and shall consist of a single transmitter\receiver and corresponding non powered reflector.
3. The detector shall operate in either a short range (16' - 230') or long range (16' - 328') when used with an extender module.
4. The temperature range of the device shall be -22 degrees F to 131 degrees
5. The detector shall feature an optical sight and 2-digit signal strength meter to ensure proper alignment of unit without need of special tools.
6. The unit shall be both ceiling and wall mountable.
7. The detector shall have the ability to be tested using calibrated test filters or magnet-activated remote test station.}
8. The detector shall have four standard sensitivity selections along with two automatic self-adjusting settings. When either of the two automatic settings is selected the detector will automatically adjust its sensitivity using advanced software algorithms to select the optimum sensitivity for the specific environment.

F. Intelligent Ionization Smoke Detector
1. The detectors shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

G. Intelligent Thermal Detectors
1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute
2. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available
3. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector
   1. The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel.
   2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

I. Addressable Dry Contact Monitor Module
   1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any normally open dry contact device) to one of the fire alarm control panel SLCs.
   2. The monitor module shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box.
   3. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
   4. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
   5. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

J. Two Wire Detector Monitor Module
   1. Means shall be provided for the monitoring of conventional Initiating Device Circuits populated with 2-wire smoke detectors as well as normally open contact alarm initiating devices (pull stations, heat detectors, etc).
   2. Each IDC of conventional devices will be monitored as a distinct address on the polling circuit by an addressable module. The module will supervise the IDC for alarms and circuit integrity (opens).
   3. The monitoring module will be compatible, and listed as such, with all devices on the supervised circuit.
   4. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
   5. The monitoring module shall be capable of mounting in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box or in a surface mount back box.
   6. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B or 3 Style D input circuits.

K. Addressable Control Module
   1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y.
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

L. Addressable Relay Module
1. Addressable Relay Modules shall be available for HVAC control and other network building functions.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires.

M. Isolator Module
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.
2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
3. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
4. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

N. Serially Connected ANN-BUS Devices
1. The panel shall support serially connected devices, these devices shall communicate with the fire alarm control panel via a two wire EIA 485 (multi-drop) communications circuit and be powered from 24 VDC Ann-Bus shall be capable of wiring distances up to 6,000 feet. System shall support a secondary serial bus. System shall support up to 8 Ann-Bus devices.
2. Supported ANN-BUS devices shall include the following:
    a. 80-Character LCD mimic annunciator capable of remote control of fire alarm panel functions.
    b. LED annunciator
    c. LED driver module for interfacing to custom graphic annunciators
    d. Serial or Parallel Printer driver module
    e. Relay module with up to 10 programmable Form-C relays

O. Door Holders:
1. Door Holders will be available in 120 VAC and 24 VDC models.
2. 120 VAC models will be transient-protected against surges up to 600 volts.
3. Door holders will be designed for Fail Safe operation (power failure release door to close).

2.06 BATTERIES AND EXTERNAL CHARGER

A. Battery:
   1. The battery shall have sufficient capacity to power the fire detection system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
   2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
   3. If necessary to meet standby requirements, external battery and charger systems may be used.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.02 TEST

A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

D. Verify activation of all flow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open signaling line circuits and verify that the trouble signal actuates.

G. Open and short notification appliance circuits and verify that trouble signal actuates.

H. Ground initiating device circuits and verify response of trouble signals.

I. Ground signaling line circuits and verify response of trouble signals.

J. Ground notification appliance circuits and verify response of trouble signals.

K. Check presence and audibility of tone at all alarm notification devices.

L. Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.

M. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

N. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.03 FINAL INSPECTION

A. At the final inspection, a minimum NICET Level II technician of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.04 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION 28 31 11

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Earthwork for this project includes but is not necessarily limited to:
   1. Layout of building and site improvements.
   2. Excavating for foundations, utilities and other below grade work.
   3. Filling and backfilling of all excavations.
   4. Rough and finish grading of the site.
   5. Granular drainage fill.

B. Perform excavation regardless of type, nature or condition of materials encountered.

C. All excavation under this Section is unclassified and no allowances will be made for nature of material encountered. Contractor shall make soil investigations as he considers necessary for his own determination of types of materials existing at the site. Refer to Section 00 31 32 for information concerning Geotechnical Investigation.

D. There will be no extra compensation for dewatering.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Samples of all imported material. Provide 25 pound bags of material to Geotechnical engineer's office at least 10 days before the material is to be imported to the site.
   2. Samples of all on-site material to be used as fill.
   3. Certification that imported materials conform to the specification requirements along with copies of the test results from a qualified commercial testing laboratory.
   4. Proctor curves on fill material as prepared by approved laboratory.

B. All fill material requires approval prior to placement.

C. Substitutions will not be considered prior to the award of the General Contract.

1.04 JOB CONDITIONS

A. Beginning work of this Section means acceptance of existing conditions.

B. Dust Control: Control dust on and near the Work if dust is caused by Contractor's operations during performance of the Work or if resulting from condition in which Contractor leaves the site.

1.05 REFERENCES

A. Arkansas State Highway and Transportation Department, Standard Specifications for Highway Construction, latest edition.
   1. AHTD Section 207 - Stone Backfill.
   2. AHTD Section 303 - Aggregate Base Course.

B. ASTM International, 100 Barr Harbor drive, PO Box C700, West Conshohocken, PA 19428-2959, USA Phone: (610) 832-9585.
   1. ASTM D698 - Test for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12 in. Drop.
   2. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
   3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10 lb. Rammer and 18 in. Drop.
   4. ASTM D2216 - Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil-Aggregate Mixtures.
   5. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   6. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   7. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

C. AASHTO - American Association of State Highway and Transportation Officials
   1. AASHTO T 27 - Sieve Analysis of Fine and Coarse Aggregates.

D. Occupational Safety and Health Administration (OSHA) Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P = Excavations.

E. Arkansas Statute 291 of 1993.

1.06 DEFINITIONS

A. Relative Compaction: The ratio, in percent, of the as-compacted field dry density to the laboratory maximum dry density as determined by the Standard Proctor Test, ASTM D698, or as determined by the Modified Proctor Test, ASTM D1557, as applicable. Corrections for oversize material may be applied to either the as-compacted field dry density or the maximum dry density, as determined by the Architect.

B. Optimum Moisture Content: Moisture content of the material for which the maximum dry density is obtained as determined by ASTM D698 or D1557. Field moisture contents shall be determined on the basis of the fraction passing the 3/4" sieve.

C. Completed Course: A course or layer that is ready for the next layer or the next phase of construction.

D. Under-Cut: Additional excavation into native soils beyond sub-grade or stripping depth that is required to provide an adequate depth of suitable backfill bearing material.

E. Sub-grade: The following shall define the sub-grade elevations:
   1. Footings: The elevation of the bottom of the footing.
   2. Building slabs: The elevation at the bottom of the capillary break.
   3. Walkways and Paving: The elevation at the bottom of the paving section.
   4. Utility Trenches: The elevation of the bottom of the pipe bedding.
   5. Landscaped Areas: The elevation below the stripping depth or the soil planting section, whichever is lower.

F. Unsuitable material shall be that material below the sub-grade elevation that does not meet bearing capacity requirements as defined by the field Geotechnical engineer. Material not previously approved by Geotechnical engineer as unsuitable will not be considered for compensation.

1.07 UNSUITABLE MATERIAL

A. The Contractor will be compensated beyond his base bid for excavation and off-site disposal of un-anticipated unsuitable soils only as verified and documented by the Geotechnical engineer in the field. No compensation will be made to the Contractor for unverified and undocumented quantities.

B. Measure in-place bank yards of material that is to be removed by field measurement that shall be observed, verified, and documented by the Geotechnical Engineer prior to backfilling with imported Granular fill. Measurement by truck tickets will not be accepted. Measurement of excavation prior to backfilling will also be used to determine the quantity of excess import required to replace the excavated material.

C. Soil integrity will be influenced by the weather conditions and the Contractor's handling and protection of the material as it is removed and placed. It is the sole responsibility of the Contractor to protect soils from the elements. The Contractor will be responsible for removing material, including previously inspected fill or exposed sub-grade, that is deemed unsuitable due to lack of protection and replacing with acceptable material at no additional cost to the Owner.

D. Compensation will not be made for material that was not defined and verified in the field as unsuitable material by the Geotechnical engineer.

PART 2 - PRODUCTS

2.01 EARTH FILL

A. Place earth fill in areas not designated to be structural fill or backfill.

B. Free from roots, organic matter, trash and debris with maximum particle size of 1-1/2 inches.

C. Imported fill is to consist of clayey sand (SC), sandy clay (CL) or clayey gravel (GC).

D. Engineered fill is to consist of approved low volume-change material designated as CL or GC soils having a Liquid Limit less than 40 and a Plasticity Index less than 20 or Class 7 Aggregate Base Course.

E. It is intended that fill be obtained from the site excavation to the maximum extent possible. DO NOT CONSTRUCT BORROW PITS ON SITE WITHOUT WRITTEN AUTHORIZATION FROM THE ARCHITECT.

2.02 STRUCTURAL (FLOWABLE) FILL

A. Imported structural fill, Controlled Low Strength Material (CLSM), is to consist of a natural or artificial mixture of sand, course aggregate, cement and water, uniformly well graded from coarse to fine. The mix shall have good workability and flowability with self-compacting and self-leveling characteristics. Conform to ASTM D4832.

B. Conform to the AHTD Section 303 classifications for Class 3, Class 4 or Class 7 as required by existing soil conditions.

2.03 UNDERSLAB DRAINAGE FILL

A. Crushed stone or washed gravel, uniformly graded from 3/4" minimum size to 1-1/2" maximum size (ASTM C-33 #57 or equivalent).

2.04 CRUSHED SYENITE FILL

A. Fill and Backfill Inside Building Walls: Crushed syenite, similar to Donna-Fill. Deliver to job in moist condition. Settle in place by completely immersing under water for optimum compaction. Keep water level above syenite at all times during placing.

2.05 TOPSOIL

A. Selected topsoil from the site, properly stored and protected, free from roots, sticks, hard clay and stones which will not pass through a 1 in. square opening. Provide analysis of topsoil to ascertain percentage of nitrogen, phosphorus, potash, soluble sale content, organic matter content, and pH value.

B. Provide imported topsoil of equal quality if required to accomplish the work.
   1. Natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. Obtain from naturally well-drained areas, without admixture of subsoil and free from Johnson grass (sorgam halepense), nut grass (cyprus rotundus), and objectionable weeds and toxic substances. Topsoil furnished shall be free from trash, brush, and stones over 1 inch in diameter, and related extraneous material.
   2. Provide to Architect soil analysis including analysis for noxious weeds, nematodes, organic content and foreign matter. Conduct analysis using methods approved by the Association of Official Agricultural Chemists of the State Agricultural Experiment Station.
   3. Preliminary soils test may be conducted by Contractor for conditional acceptance by Architect. Shipping and delivery of topsoil may begin after acceptance of preliminary test findings, when acceptable. Conduct additional soils tests specified in soils testing lab.

C. **Topsoil Removal:** Prior to the commencement of construction, the site shall be cleared of all vegetation in construction areas. After the site is cleared, all topsoil shall be stripped from the site and an adequate amount stored (4 inch minimum thickness) for reuse on the site for final seeding or landscaping. Excess topsoil may be used on embankment slopes or excavated slopes after final compaction of the embankment material or back-slopes. No topsoil shall be placed in areas to receive pavement, sidewalks or structures. Topsoil, because of its compressible organic content, shall not be used in areas that will support embankments, structures, or pavements. See Geotechnical Report for approximate stripping depths required.

2.06 COMPACTION EQUIPMENT

A. Provide compaction equipment of suitable type and adequate to obtain the densities specified.

B. Operate compaction equipment in strict accordance with the manufacturer's instructions and recommendations.

C. Maintain equipment in such condition that it will deliver the manufacturer's rated compactive effort.

D. Hand operated equipment shall be capable of achieving the specified densities.

2.07 MOISTURE CONTROL EQUIPMENT

A. Provide equipment for applying water of a type and quality adequate for the work; it shall not leak and shall be equipped with a distributor bar or other approved device to assure uniform application.

B. Provide equipment for mixing and drying out material consisting of blades, discs or other approved equipment.

2.08 WATER REMOVAL EQUIPMENT

A. Provide and operate equipment adequate to keep excavation and trenches free of water. including but not limited to pumps and hoses.

2.09 SELECTED MATERIAL ACCEPTANCE

A. Provide samples for testing representative of the actual material to be installed in the work. Take samples from material stockpiled. Depending on the uniformity of the material, Architect may request additional samples.

B. Tests required at the borrow area:
   1. Standard Proctor.
   2. Atterberg limits.

C. Forward test results to Architect at least 10 days before the material is required for use. If tests indicate that the material does not meet specification requirements, the material shall not be installed in the work.

D. Material which is placed in the work but does not conform to the specification requirements shall be removed and replaced at the Contractor's expense.

2.10 OTHER MATERIALS

A. Provide materials, not specifically described but required for proper completion of work of this Section, selected by Contractor subject to Architect approval.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

A. Complete clearing and grubbing work as specified in Section 02 41 13 prior to beginning work in this section.

3.02 LAYOUT AND STAKING

A. The Contractor will employ and pay a competent, independent, Registered Professional Land Surveyor with demonstrated ability to perform the layout work required.

B. Definitions
   1. "Control Stakes" are the original reference points set by Engineer for the construction work.
   2. "Construction Staking" is an additional staking required as the project progresses which is the responsibility of Contractor.

C. Engineer shall provide the following staking:
   1. Set temporary bench marks.
   2. Reset stakes found to be in error.

D. Contractor shall provide the following staking:
   1. All construction staking except as provided by Engineer above.
   2. Reset stakes, marks or pins lost due to Contractor's operations.

E. Electronic copies of surveying staking points will not be made available for this project.

F. Control Staking
   1. Notify Engineer, in writing, at least five days in advance of the date when control staking services are desired.
   2. Engineer shall provide control staking.
   3. Examine stakes before commencing operations.
   4. Notify Engineer if validity of any control stake is questionable.
   5. Engineer will check stake or stakes in question.
   6. Any control stakes found to be in error will be reset by Engineer.
   7. If stakes are valid, Contractor shall pay for cost of checking stakes.
   8. Contractor shall inform his employees, subcontractors and vendors of importance of control stakes and the necessity of their preservation.
   9. Contractor shall pay for resetting any control stakes, marks, or pins lost due to Contractor's operations.

G. Construction Staking
   1. Provide all construction staking as needed to complete the Work.

H. If site conditions vary from those indicated, the Contractor shall notify the Architect immediately.

3.03 STRUCTURAL EXCAVATION

A. Excavate subsoil required for building foundations both interior and exterior, construction operations and other work. Excavate for structures to the lines and grades shown or as required to accomplish the construction.
   1. After excavating footings and prior to placing any fill material, Contractor is to arrange for qualified testing agency to perform hand held penetrometer tests at 10 foot intervals along entire length of perimeter footing and along all interior grade beams to determine that minimum soil bearing capacity has been achieved.

B. The method of excavation used is optional; however, no equipment shall be operated within 5 feet of existing structures or newly completed construction.

C. Excavation that cannot be accomplished without endangering present or new structures shall be done with hand tools.

D. Machine slope banks to angle of repose or less until shored.

E. Excavate to the depths and widths required.

F. Do not interfere with normal 45 degree bearing splay of foundations.

G. Allow for forms, working space, granular base and finish topsoil.

H. Do not carry excavation for footings and slabs deeper than the elevation shown.
   1. Fill over excavations under footings with concrete of equal strength to that of the footing when excavations are deeper than the elevation shown.
   2. Replace excavation carried below the grade lines shown or established by the Architect with the same fill Material as specified for the overlying fill or backfill, compact as required for such overlying fill or backfill.
   3. Where the overlying area is not to receive fill or backfill, replace the over excavated material and compact to a density not less than that of the underlying ground.
   4. Correct over excavated areas and unauthorized excavation at the Contractor's expense.

I. Correct cuts below grade by similarly cutting adjoining areas and creating a smooth transition.

J. Hand trim excavation and leave free of loose matter.

K. Remove lumped subsoil, boulders and rock.

L. Stockpile excavated material in area designated on site and remove excess subsoil not being reused from site.

3.04 EXCAVATION SAFETY

A. The Contractor shall be solely responsible for making the excavation in a safe manner.

B. Provide appropriate measures to retain excavation side slopes to ensure that men working in or near the excavation are protected.

3.05 DEWATERING EXCAVATION

A. Remove water during periods when concrete is being deposited, pipe is being laid and placing of backfill unless water settling is required and at such other times as required for efficient and safe execution of the work.

B. Accomplish removal of groundwater in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes and will not result in damage to existing structures.

C. Where necessary to these purposes, lower water level in advance of excavation, utilizing wells, wellpoints or similar methods.

D. Maintain the water level in the gravel stratum as measured in piezometers, a minimum of 3 feet below the prevailing excavation.

E. Open pumping, sumps and ditches: If these methods result in boils, loss of fines, softening of the ground or instability of slopes, they will not be permitted.

F. Install wells and wellpoints with suitable screens and filters so that continuous pumping of fines does not occur.

G. Operate well points continuously so as to prevent boils and loss of consolidation.

H. Arrange discharge to facilitate collection of samples by Architect.

I. Avoid settlement or damage to adjacent property.

J. Dispose of water in a manner that will not damage adjacent property, as approved by Architect.

3.06 UNDERCUTTING

A. Undercut areas on the site that do not meet the permeability requirements to such depth as to allow placement of sufficient impervious material as determined by permeability testing at borrow area as stated in Part 2 of this section.

B. Prior to placement of fill in the undercut area, scarify the upper 6" of subgrade and re-compact to 95 percent of ASTM D1557. Refer to the Geotechnical Report.

3.07 FOUNDATION SUBGRADE PREPARATION

A. After completion of excavation and prior to foundation or fill construction, proofroll the excavation surface with a loaded tandem-axle dump truck or similar heavy wheeled vehicle to detect soft or loose zones.

B. Conduct proof-rolling in the presence of Architect.

C. If soft or loose zones are found, excavate the material to a depth accepted by Architect, then fill and compact as specified for the overlying fills.

D. Prior to placement of overlying fill or concrete, scarify the upper 6" of subgrade and re-compact the foundation subgrade to at least 98 percent of ASTM D-698. Refer to the Geotechnical Report.

3.08 FILL MATERIAL

A. Place structural fill material within the influence area beneath all piping, slabs, structures and other areas of excavation.

B. Place fill in 6" loose lifts and compact each lift to 98 percent of ASTM D-698. Refer to the Geotechnical Report.

C. Moisten material as required to aid compaction (+ or - 2 percent optimum moisture content).

D. Place material in horizontal lifts and in a manner which avoids segregation.

E. Correct and repair subsequent damage to slabs, piping, concrete structures, facilities or other structures caused by settlement of fill material.

3.09 BACKFILL

A. Remove form materials and trash from excavation before placing backfill.

B. Do not operate earth moving equipment within 5 feet of walls of concrete structures for the purpose of depositing or compacting backfill material.

C. Compact backfill adjacent to concrete walls with hand operated tampers or similar equipment that will not damage the structure.

D. Place backfill material in 6" loose lifts and compact each lift to 95 percent of ASTM D-698. Refer to the Geotechnical Report.

E. Backfill all utility excavations and compact to minimum 95 percent of ASTM D698.

3.10 SUBGRADE PREPARATION AND FILL MATERIAL AT PAVED AREAS

A. Paved areas include areas to receive Gravel Surfacing, Asphalt Concrete Paving, Portland Cement Concrete Paving, etc.

B. Scarify upper 6" of natural subgrade and recompact to 98 percent of ASTM D-698.

C. Place structural fill material to the lines and grades shown in maximum 6" loose lifts and compact each lift to not less than 98 percent of ASTM D-698. Refer to the Geotechnical Report.

3.11 MOISTURE CONTROL

A. During compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of fill.

B. Maintain moisture content uniform throughout the lift.

C. Add water to the material at the site of excavation. Supplement, if required, by sprinkling the fill.

D. At the time of compaction, maintain the water content of the material at optimum moisture content, plus or minus 2 percent, except as otherwise specified for embankments.

E. Do not attempt to compact fill material that contains excessive moisture.

F. Aerate material by blading, discing, harrowing or other methods to hasten the drying process.

3.12 FIELD DENSITY TESTS

A. Test Methods: ASTM D2922, D2216 and D3017.

B. Cooperate with testing work by leveling small test areas designated by the Architect.

C. Backfill test areas.

D. Field density test shall be performed for every 50 cubic yards of fill material placed.

E. Architect may order testing of any lift of fill at any time, location or elevation.

3.13 FINISH SITE GRADING AND TOPSOIL PLACEMENT

A. **Finished Grading:** After all structures have been completed and all backfills have been compacted, all areas on the project construction site which have been disturbed by the Contractor shall be brought to true grade with a minimum of 4 inches of topsoil. Perform earthwork to lines and grades as shown with proper allowance for topsoil.

B. Provide a minimum 4" depth of topsoil in all areas within the limits of construction that are disturbed during the course of this work except areas that are to receive sod or paving material.
   1. Areas To Receive Sod: After subgrade preparation, furnish, place, and spread 3" minimum thickness of topsoil over earth areas to be sodded. Do not spread topsoil in frozen or muddy condition. Make allowance for settlement to obtain 3" finished full depth of topsoil. Till thoroughly areas where existing topsoil has not been removed to depth of at least 3" until condition of soil is friable and of uniform texture. Remove stones over 1" in diameter, sticks, and rubbish.

C. Shape, trim and finish slopes to conform with the lines, grades and cross sections shown.

D. Make slopes free of loose exposed roots and stones exceeding 3 inches in diameter.

E. Round tops of banks to circular curves, in general, not less than a 6 foot radius.

F. Neatly and smoothly trim rounded surfaces; over excavating and backfilling to the proper grade are not acceptable.

G. Finish site grading will be reviewed by Architect.

3.14 DISPOSAL OF EXCESS EXCAVATION

A. Dispose of excess excavated materials, not required or suitable for use as backfill or fill outside of the area of work.

B. Compact excess material as specified for fill, dress the completed disposal area to slopes no greater than 4:1 (horizontal:vertical) and slope to drain.

3.15 SETTLEMENT

A. Settlement in backfill, fill or in structures built over the backfill or fill, which may occur within the 1-year guarantee period in the General Conditions will be considered to be caused by improper compaction methods.

B. Restore structures damaged by settlement to original condition.

END OF SECTION 31 00 10

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work of this Section also includes, but is not necessarily limited to:
   1. Backfill required by undercutting.
   2. Imported pipe zone material.
   3. Trench settlement repair, including replacing roadway surfacing, sidewalk, or other structures.
   4. Replacing damaged culverts.

B. Trench excavation is classified as common excavation and includes removal of material of whatever types encountered including rock to depths shown or as directed by Design Professional.

C. Pipe zone includes full width of excavated trench from bottom of pipe to a point 6 inches above top outside surface of pipe barrel.

D. Conform to federal, state, and local codes governing safe loading of trenches with excavated material.

E. The right is reserved to modify the use, location, and quantities of the various types of backfill during construction as Engineer considers to be in the best interest of Owner.

F. There shall be no extra compensation for dewatering. Contractor is to provide all necessary equipment including but not limited to pumps and hoses as needed to maintain the integrity of the site.

G. There shall be no extra compensation for rock encountered in footing or trench excavation performed by standard heavy-duty equipment such as a Caterpillar D-8 dozer with single tooth ripper, a Caterpillar 330B tracked excavator equipped with rock teeth or equipment of similar power and capability. Rock not able to be excavated with this category of equipment will be compensated.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. All fill material requires approval prior to placement.

C. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959.
   1. ASTM D448 - Classifications for Standard Sizes of Aggregate and Bridge Construction.
   2. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. Rammer and 12-inch Drop.
   3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 10-lb. Rammer and 18-inch Drop.
   4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.
   5. ASTM D2922 - Test Methods for Density of Soils and Soil-Aggregates in Place by Nuclear Method.

B. Occupational Safety and Health Administration (OSHA) Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P = Excavations.

C. The Contractor shall be solely responsible for trench and excavation safety systems in accordance with Arkansas Statute 291 of 1993.

PART 2 - PRODUCTS

2.01 FOUNDATION STABILIZATION

A. Crushed gravel or crushed rock, meeting the requirements of Class 7 AHTD Aggregate Base.

2.02 PIPE ZONE MATERIAL

A. Crushed granular material conforming to ASTM D448, Size No. 67, or Class 7 per Section 303 AHTD.

B. Washed stone bedding size 1/4-inch to 3/4-inch. In areas of soft trench sidewalls and for all sanitary sewer pipe zone material, crushed material must be used, compacted to 98 percent MDD, Standard Proctor.

2.03 COMMON FILL MATERIALS

A. Material shall not contain pieces larger than 2 inches, and shall be free of roots, debris, or organic matter.

2.04 SELECT FILL MATERIAL

A. Class 7, Class 3, and Class 4 as outlined in AHTD Section 303.

B. ASTM Soil Classification GC as set forth in ASTM Designation D2487-92. On site material may be used, provided it is in accordance with ASTM D2487-92.

2.05 TRENCH BACKFILL

A. Backfill:
   1. Natural or artificial mixture of gravel and mineral soil mortar uniformly well graded from coarse to fine.
   2. AHTD Section 303 Class 3, Class 4, or Class 7 as specified in this Section.
   3. All trench backfill under pavement or building is to be Class 7, compacted to 98 percent MDD, Modified Proctor.

2.06 COMPACTION EQUIPMENT

A. Provide compaction equipment of suitable type and adequate to obtain the densities specified.

B. Operate compaction equipment in strict accordance with the manufacturer's instructions and recommendations.

C. Maintain equipment in such condition that it will deliver the manufacturer's rated compactive effort.

D. Hand operated equipment shall be capable of achieving the specified densities.

2.07 EXCAVATION EQUIPMENT

A. Suitable type and adequate to perform the work required. Rock removal will be considered common excavation if removable by standard heavy duty equipment such as a Caterpillar D-8 Dozer with a single tooth ripper, a Caterpillar 330B tracked excavator equipped with rock teeth or equipment of similar power and capability.

B. Operate in strict accordance with manufacturer' s instructions and recommendations and maintain in such condition so that it will deliver manufacturer' s rated effort.

PART 3 - EXECUTION

3.01 PREPARATION

A. Cut trees and brush as near to surface of ground as practicable, remove stumps, and pile for disposal.

B. Do not permit excavated materials to cover brush or trees prior to disposal.

3.02 PREVENT TRENCH WATER AND ANIMALS FROM ENTERING PIPE

A. When pipe laying is not in progress, including noon hours, open ends of pipe shall be closed; and no trench water, animals, or foreign material shall be permitted to enter the pipe.

3.03 DISPOSAL OF CLEARED MATERIAL

A. Dispose of material in such a manner to meet requirements of state, county, and local regulations regarding health, safety, and public welfare.

B. Dispose of nonflammable and flammable material off the construction site in an approved location.

C. Do not leave material on the Project site, shove onto abutting private properties, or bury in embankments or trenches.

3.04 REMOVAL OF OBSTRUCTIONS

A. Remove obstructions within trench area or adjacent thereto such as tree roots, stumps, abandoned piling, logs, and debris.

B. Engineer may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made without adversely affecting the intended function of the facility.

C. Dispose of obstructions in accordance with this Section.

3.05 REMOVAL AND REPLACEMENT OF TOPSOIL

A. Where trenches cross lawns, garden areas, pasture lands, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove topsoil for a depth of 6 inches for full width of trench to be excavated.

B. Use equipment capable of removing a uniform depth of material.

C. Stockpile removed topsoil at regular intervals, and do not mix with other excavated material.

D. Locate stockpiles so that material of one type is not mixed or stockpiled on material of another type.

E. Minimum finished depth of topsoil over trenches: 8 inches.

F. Imported topsoil may be substituted for stockpiling and replacing topsoil.

G. Maintain finished grade of topsoil level with area adjacent to trench until final acceptance by Design Professional.

H. Repair damage to adjacent topsoil caused by work operations.
   1. Remove rock, gravel, clay, and other foreign materials from the surface.
   2. Re-grade.
   3. Add topsoil as required.

3.06 TRENCH WIDTH

A. Minimum width of un-shored trenches where pipe is to be laid shall be 18 inches greater than the outside diameter of the pipe, or as approved.

B. Maximum width at top of trench will not be limited, except where excess width of excavation would cause damage to adjacent structures or property or cause undue stresses on the pipe.

C. Confine trench widths to allowable work area or construction easements, unless special written agreements have been made with Owner.

3.07 EXCAVATION

A. Excavate trench to lines and grades shown or as established by Engineer with proper allowance for pipe thickness and for pipe base or special bedding when required.

B. If trench is excavated below required grade, correct with foundation stabilization material.

C. Place material over full width of trench in compacted layers not exceeding 6 inches deep to established grade with allowance for pipe base or special bedding.

3.08 PREPARATION OF TRENCH - LINE AND GRADE

A. Do not deviate more than ½ inch from line or ½ inch from grade. Measure for grade at the pipe invert, not at the top of the pipe, because of permissible variation in pipe wall thickness.

B. Grade the bottom of the trench by hand to the line and grade where the pipe is to be laid, with proper allowance for pipe thickness and for pipe base when specified or indicated.

C. Remove hard spots that would prevent a uniform thickness of bedding.

D. Check the grade with a straightedge and correct irregularities found.

E. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between bell holes, except that the grade may be disturbed for the removal of lifting tackle.

3.09 SHORING OF TRENCH LINES

A. Shore trench when necessary to prevent caving during excavation in unstable material or to protect adjacent structures, property, workers, and the public.

B. Increase trench widths accordingly by the thickness of the shoring material.

C. Maintain shoring in place until pipe has been placed and backfilled at pipe zone.

D. Remove shoring and as backfilling is done in a manner that will not damage pipe or permit voids in backfill.

E. Conform to safety requirements of federal, state, and/or local public agency having jurisdiction for shoring and bracing of trenches. The most stringent of these requirements shall apply.

3.10 LOCATION OF EXCAVATED MATERIALS

A. Place excavated material only within construction easement, right-of-way, or approved working area.

B. Do not obstruct private or public traveled roadways or streets.

3.11 REMOVAL OF WATER

A. Provide and maintain ample means and devices to promptly remove and dispose of water entering trench during time trench is being prepared for pouring of footings, pipe laying, during laying of pipe, and until backfill is completed.
   1. These provisions apply during the noon hour as well as overnight.
   2. Provide necessary means and devices, as approved, to positively prevent water from entering the construction area of another contractor.

B. Dispose of water in a manner to prevent damage to adjacent property.

C. Drainage of trench water through the pipeline under construction is prohibited.

3.12 FOUNDATION STABILIZATION

A. When existing material in bottom of trench is unsuitable for supporting pipe or footing, excavate unsuitable material.

B. Backfill trench to sub-grade of footing or pipe base with foundation stabilization material specified.

C. Place foundation stabilization material over the full width of trench and compact in layers not exceeding 6 inches deep to required grade by making passes with a vibratory compactor (or equivalent).

D. Material shall be considered unsuitable when it contains more than 5 percent organic material by volumetric sampling or when it will not support a reading of 1.5 on a hand penetrometer.

3.13 ROCK IN TRENCH

A. Where rock is encountered in bottom of pipe trench, support pipe on a minimum of 4-inches of bedding material or one-eighth of the outside diameter of pipe, whichever is greater.

B. Where rock is encountered in bottom of footing trench, excavate rock as needed to provide level bearing surface for footing.

3.14 PIPE ZONE BACKFILL

A. Depth of the pipe zone above pipe barrel varies with pipe material.

B. Particular attention must be given to area of pipe zone from invert to centerline of pipe to ensure firm support is obtained to prevent lateral movement of pipe during final backfilling of pipe zone.

C. Backfill area of pipe zone from bottom of pipe to horizontal centerline of pipe by hand-placing material around pipe in 4-inch layers.

D. Achieve continuous support beneath pipe haunches by “walking in” and slicing with shovel.

E. Backfill area of pipe zone from horizontal centerline to top of pipe zone with pipe zone material as determined by class of backfill or shown in the documents.

F. In lieu of selected material for pipe zone in upper portion of pipe zone, imported pipe zone material approved by Engineer for trench backfill may be substituted.

3.15 TRENCH BACKFILL ABOVE PIPE ZONE

A. When backfill is placed mechanically, push backfill material onto slope of backfill previously placed and allow to slide down into trench.

B. Do not push backfill into trench in such a way as to permit free fall of material until at least 2 feet of cover is provided over top of pipe.

C. Under no circumstances allow sharp, heavy pieces of material to drop directly onto pipe or tamped material around pipe.

D. Do not use backfill material of consolidated masses larger than ½ cubic foot.

3.16 EXCESS EXCAVATED MATERIAL

A. Dispose of excess excavated material off project site in an approved area.

3.17 PIPE COVER

A. Place select material from excavation over pipe to provide minimum coverage, as shown on Drawings or as directed by Design Professional.

3.18 DRAINAGE DITCH RESTORATION

A. Under-crossings of minor drainage ditches not covered in another Specification Section shall be backfilled so that upper 1 foot of material in ditch between ditch banks is clay.

B. Compact material for full ditch width by 6 passes of vibratory compactor (or equivalent).

3.19 SETTLEMENT

A. Correct settlement noted in backfill, fill, or in structures built over backfill or fill within warranty period.

END OF SECTION 31 23 10

PART 1 - GENERAL

1.01 DESCRIPTION

A. Perform foundation and under floor termite control treatment in accordance with the Arkansas Pest Control Law and to qualify construction under this Contract for continuous guaranteed protection specified.

B. Applicable Regulations:
   1. International Building Code
   2. Arkansas Pest Control Law, A.C.A. 17-30-101 et. Seq. and Regulations
      a. Circular 6 revised December, 2013
      b. Arkansas State Plant Board
   3. Federal Insecticide, Fungicide and Rodenticide Act, (Public Law 92-516 of Oct. 21, 1972 as amended by Public Law 100-532, October 25, 1988).

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Submit a Termicide Application Plan, including Product Data, Design Data, Test Reports and Certificates.

1.04 GUARANTEE

A. Furnish damage guarantee with service and re-service for any subterranean termite infestation without cost to Owner. Write Damage Guaranty Contract additionally to cover any and all subterranean termite damage to the structures and contents in amount of $10,000. Such damage to be repaired, replaced or corrected at Contractor's expense.

B. Furnish damage guarantee effective for 5 year period after completion of initial treatment without payment of additional fees or premiums by Owner. Upon expiration of 5-year period, Owner has option of extending damage guarantee contract at an annual fee mutually agreed upon by Owner and applicator. Owner reserves the right to cancel as of

any anniversary date. Service, re-service, and Damage Guaranty provisions of the extended damage contract are noncancellable by applicator. Annual fee subject to revision by giving advance written notice to Owner.

C. Include in the warranty annual inspections of the buildings, whether new or renovated, or building additions during the warranty period. If live subterranean termite infestation or subterranean termite damage is discovered during the warranty period, and the soil and building conditions have not been altered in the interim:
   1. Re-treat the site and perform other treatment as may be necessary for elimination of subterranean termite infestation;
   2. Repair damage caused by termite infestation; and
   3. Reinspect the building approximately 180 days after the re-treatment.

1.05 ADMINISTRATIVE

A. Coordinate work related to final grades, landscape planting, foundations, or any other alterations to finished or renovated construction which might alter the condition of treated soils with this specification.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Chemical termite control uses liquid termiticide treatments applied to the soil, forming a continuous chemical barrier in the soil around both sides of the foundation. The application may be surface applied or rodded and trenched. This barrier prevents foraging termites from reaching the foundation and piers. Only the soil adjacent to these foundation elements is treated. For slab construction (including foundations, patios and garages), the entire soil (or gravel) surface shall be treated before the vapor barrier is installed and the slab poured over it. Soil treatment shall be coordinated with all building activities from foundation construction through final grading of the soil around the building's exterior. In order for the treatment to be effective, the final phase of the application must be done after final grading and, where required, after landscaping is completed so that treated soil is not disturbed.

2.02 TERMITE CONTROL CHEMICALS

A. Use chemicals approved by the Arkansas State Plant Board and of type required to give guaranteed protection specified.

PART 3 - EXECUTION

3.01 PREPARATION

A. From investigation at the site determine soil texture or otherwise obtain this information from the County Agent, Soil Conservation Service or other approved authorities, if not already known.

B. Eliminate food sources by removing debris from clearing and grubbing and post construction wood scraps such as ground stakes, form boards, and scrap lumber from the site, before termiticide application begins.

3.02 TREATMENT

A. Perform foundation and under floor termite control treatment at buildings to be constructed under this Contract. Use type chemical approved by the Arkansas State Plant Board and currently known to give guaranteed protection for the soil and fill used at this Project. Apply chemical using applicator licensed by the Arkansas State Plant Board. Apply in sufficient quantity under and around the structures, to qualify building and contents for continuous guaranteed protection against damage by subterranean termites.

B. Reapply soil treatment solution to areas disturbed by subsequent excavation or construction activities following application.

C. **Under New Slabs:** Apply under slabs at the rate recommended by manufacturer. Apply after placement of gravel drainage fill and immediately prior to placement of vapor barrier. When necessary to insure proper penetration, the ground surface will be left loose or lightly scarified until treatment has been completed.

D. Critical Areas: Treat a one foot strip along critical areas under walls, around interior piers and pipes rising from the ground at the rate recommended by manufacturer. Treatment shall be applied as specified for overall treatment under slabs.

E. Outside of Foundations: Apply a one foot strip along the outside of the foundations of the building at the rate recommended by manufacturer. Apply in a trench dug to a depth of approximately 2" below finish grade. Loosen earth in trench to a depth of 12" before treating. This treatment is to be performed prior to finish grading.

1. If the exterior perimeter treatment is applied when the horizontal barrier is applied it will be damaged or removed before construction is completed. The exterior foundation perimeter treatment will have to occur in phases when any pads, porches, aprons, sidewalks, final grading or landscape planting are simultaneously involved adjacent to the building foundation. This treatment area should be coordinated after all major construction but before any pads, porches, or other items requiring special consideration are poured adjacent to the foundation walls. Submit written verification that final grading, landscape planting and other items adjacent to the foundation will not disturb treatment of the soil on the exterior sides of foundation walls, grade beams, and similar structures.

3.03 APPLICATION PLAN

A. Prior to commencing application of termiticide, submit a Termiticide Application Plan addressing the following items:
   a. proposed sequence of treatment work including dates and times of application
   b. termiticide trade name
   c. EPA registration number
   d. chemical composition
   e. concentration of original and diluted material
   f. formulation
   g. manufacturer's recommended application rates
   h. regional requirements
   i. application rate of active ingredients
   j. method of application
   k. area or volume to be treated
   l. amount to be applied
   m. copy of the pest control business license
   n. copy of the pesticide applicator certificates

3.04 APPLICATION

A. For areas to be treated, establish complete and unbroken vertical and horizontal soil poison barriers between the soil and all portions of the intended structure which may allow termite access to wood and wood related products. Make applications to crawl spaces in accordance with label directions. Applications to crawl space areas that are used as plenum air spaces will not be permitted.

3.05 EQUIPMENT CALIBRATION AND TANK MEASUREMENT

A. Submit a list of equipment to be used. Conduct calibration test on the application equipment to be used immediately prior to commencement of termiticide application. Measure the volume and contents of the application tank. Testing must confirm that the application equipment is operating within the manufacturer's specifications and meets the specified requirements. Submit written certification of the equipment calibration test results within 1 week of testing. Where results from the equipment calibration and tank measurements tests are unsatisfactory, re-treatment will be required.

3.06 FIELD QUALITY CONTROL

A. Verification of Measurement
   1. Once termiticide application has been completed, measure tank contents to determine the remaining volume. The total volume measurement of used contents for the application must equal the application rate established in the application plan. Submit written verification that the volume of termiticide used meets the application rate established in the application plan.

B. Inspection

1. Technical Representative: Provide a technical representative who is a certified pesticide applicator. The technical representative must be present at all meetings concerning treatment measures for subterranean termites and during treatment application.

3.07 CLOSEOUT ACTIVITIES

A. Upon completion of this work, submit the Pest Management Report, or an equivalent computer product, to the contractor. This form shall identify the target pest, type of operation, brand name and manufacturer of pesticide, formulation, concentration or rate of application used.

3.08 PROTECTION OF TREATED AREA

A. Immediately after the application, protect the area from other use by erecting barricades as required or directed, including signage. Place signage inside the entrances to crawl spaces and identify the space as treated with termiticide and not safe for children or animals. Cover treated areas with plastic if slab is not to be poured immediately following termiticide application.

B. Disturbance of Treated Soils

1. Re-treat soil and fill material disturbed after treatment before placement of slabs or other covering structures.

END OF SECTION 31 31 16

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Providing Portland cement concrete for the following where applicable:
   1. Parking and Drives
   2. Sidewalks and Steps
   3. Curbs and Gutters

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. American Concrete Institute, 22400 W. Seven Mile Road, Detroit, Michigan 48219.
   1. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.

B. American Society for Testing and Materials, 1961 Race Street, Philadelphia, Pennsylvania 19103.
   1. ASTM C94 - Specification for Ready-Mixed Concrete.
   2. ASTM C 150 - Specification for Portland Cement.
   3. ASTM C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   4. ASTM A 615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. Rammer and 12 in. Drop.
   6. ASTM D994 - Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   7. ASTM C-1018 Standard Test Method for Flexural Toughness and First Strength of Fiber Reinforced Concrete (Using Beam with Third Point Loading).
   8. ASTM D 1751 - Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruded and Resilient Bituminous Types).

1.05 INSPECTION AND TESTING

A. Inspection and testing of concrete shall be performed by a firm appointed by Owner and paid for by Contractor.

B. Three concrete test cylinders will be taken for every 75 or less cubic yards placed each day. One additional test cylinder will be taken during cold weather concreting, and be cured on job site under same conditions as concrete it represents. One slump test shall be taken for each set of test cylinders taken.

PART 2 - PRODUCTS

2.01 MATERIALS AT PARKING AND DRIVES

A. Subgrade: In accordance with Section 31 00 10.

B. Base Course: 4 inches of crushed stone uniformly graded from 1/4" to 1-1/4".

C. Concrete Materials
1. Portland Cement: ASTM C 150; Normal-Type I. Concrete shall have minimum 4000 psi @ drives minimum compressive strength at 28 days with maximum slump of 3 inches and 4 to 6 percent air entrainment. 5 inch thickness required. **Refer to recommendations in the Geotechnical Report.**
2. Fine and Coarse Aggregates: ASTM C 33.
3. Water: Clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious material.
4. No fly ash will be allowed.
5. Use accelerating admixtures in cold weather only when approved by Architect. Use of admixtures shall not relax cold weather placement requirements. Do not use calcium chloride.
6. Use set-retarding admixtures during hot weather only when approved by Architect.
7. Air Entrainment: Comply with AFPC V2 Tables 1603A and 1603C.

D. Reinforcement:
1. Wire Fabric: "Specifications for Wire Fabric for Concrete Reinforcement", ASTM A-185.
2. Bars for Reinforcement: "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement", ASTM A-615, grade 60 unless otherwise shown.

E. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete.

2.02 MATERIALS AT SIDEWALKS AND CURB AND GUTTER

A. Curb and Gutter Forms:
   1. 2-inch dressed dimension lumber or metal of equal strength, free from defects that would impair appearance or structural quality of completed curb, subject to approval of Architect.
   2. Short Radius Forms: 1-inch dressed lumber or plywood.
   3. Curb Face: No horizontal joints in form material closer than 7 inches from top of curb.
   4. Stakes and Bracing Materials: Provide as required to hold forms securely in place.

B. Sidewalk Forms:
   1. 2-inch dressed lumber, straight and free from defects, or standard metal forms.
   2. Short Radius Forms: 1-inch dressed lumber or plywood.
   3. Stakes and Bracing Materials: Provide as required to hold forms securely in place.

C. Concrete Materials:
   1. Ready mixed conforming to ASTM C94, Alternate 2.
   2. Compressive Strength: 3,500 psi at 28 days.
   3. Maximum Size of Aggregate: 1-1/2 inch.
   4. Slump: 2 to 4 inches.
   5. Air Entrainment: Comply with AFPC V2 Tables 1603A and 1603C.

D. Reinforcement:
   1. Wire Fabric: "Specifications for Wire Fabric for Concrete Reinforcement", ASTM A-185.

2.03 CURING COMPOUND

A. Liquid membrane forming, clear or translucent, suitable for spray application. Conform to ASTM C 309, Type 1. Safe-Cure™ 800 by ChemMasters, Inc. or approved equal.

2.04 JOINT SEALANT

A. ASTM C920. Non-priming, pourable, self-leveling polyurethane. Subject to compliance with project requirements manufacturers offering joint sealants which may be incorporated in the Work include, but are not limited to the following:
   1. Sonolastic Paving Joint Sealant, by Sonneborn.
   2. Sonomeric CT 1 Sealant, by Sonneborn.
   3. Sonomeric CT 2 Sealant, by Sonneborn.
   4. Vulkem 45, by Mameco.
   5. "THC-900" - Tremco, Cleveland, OH (216) 292-5000.

2.05 EXPANSION JOINT FILLER

A. Minimum 1/2-inch thick asphaltic impregnated fiberboard conforming to ASTM D 1751.
   1. "Flexcell" - Celotex Corp., Tampa, FL (813) 871-4811.
   2. "Seal Tight Fiber Expansion Joint" - W.R. Meadows, Inc., Elgin, IL 93120 742-4501.

2.06 CONSTRUCTION JOINT MATERIALS

A. Provide a full slab depth 24 gauge metal pre-shaped key, approximate depth of key to be 1/4 slab thickness and a key width of about 1/10 slab thickness.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. Subgrade for concrete paving improvements shall have all organic silty and clayey topsoils and other unsuitable material removed and replaced with approved material. Fill and tamp traces of utility trenches. Scarify and re-compact subgrade in accordance with Section 31 00 10; proof roll with dump truck. Replace soft spots as needed.

3.02 PARKING AND DRIVES CONSTRUCTION

A. Place drainage course material on prepared subgrade. Spread course(s) and compact the same day the material is hauled. The material shall be thoroughly mixed, either by repeated handling with a blade grader or by harrowing sufficiently to secure a uniform mixture of coarse and fine particles. Compact drainage course by systematically rolling and watering using three passes with a vibratory steel wheel roller set on medium frequency.

B. Forming:
   1. Form vertical surfaces to full depth and securely position to required line and levels. Ensure form ties are not placed so as to pass through concrete.
   2. Arrange and assemble formwork to permit easy dismantling and stripping, and to prevent damage to concrete during formwork removal.
   3. Place keyed construction joints as required.
   4. Place contraction joints as shown and not exceeding 15 feet on center. Depth to equal 1/4 of thickness of paving.
   5. Place expansion joints as shown and not exceeding 60 feet on center. Apply joint sealant specified.
   6. Fit longitudinal and cross joints with filler of required profiles. Recess joint filler 1/4-inch below finished concrete surface to allow for placement of sealant.

C. Placing Concrete:
   1. Place concrete continuously between predetermined construction joints.

2. Screed and wood float surfaces to uniform finish, free to open texturing and exposed aggregate.
3. Avoid working mortar to surface.
4. Round edges, including edges of expansion and construction joints, with 1/4-inch radius edging tool.

D. Finishing:
1. Finish exposed concrete paved vehicular surfaces with wood float finish except where light broom finish is specified. Ensure finished surfaces do not vary from true lines, levels, or grade, by more than 1/4-inch in 10 feet in any direction when measured with straight edge.
2. Install specified joint sealant in accordance with manufacturer's instructions. Joints that exceed 1/4" per foot slope must be primed in accordance with manufacturers recommendations.
3. **DO NOT ALLOW ANY TRAFFIC OR LOADS OF ANY KIND ON CONCRETE FOR A PERIOD OF 14 DAYS MINIMUM. DO NOT ALLOW ANY HEAVY TRUCKS OR MACHINERY ON CONCRETE FOR A PERIOD OF 28 DAYS. MINIMUM**.

3.03 CURB CONSTRUCTION

A. Construct curbs to line and grade shown or established by the Architect and conform to the details shown.

B. Place, process, finish and cure concrete in conformance with this section and the applicable requirements of ACI 614. Wherever requirements differ, the more stringent shall govern.

C. Asphalt Impregnated Expansion Joints:
1. At intervals of not more than 60 feet.
2. Beginning and end of curved portions of the curb.
3. Connections to existing curbs.
4. Apply joint sealant specified.

D. Contraction Joints:
1. Place at intervals not exceeding 10 feet.
2. Open type joint.
3. Provide by inserting thin, oiled steel sheet vertically in fresh concrete to force coarse aggregate away from joint.
4. Steel sheet shall be inserted the full depth of the curb.
5. After initial set has occurred in the concrete and prior to removing the front curb form, steel sheet shall be removed with a sawing motion.

E. As soon as concrete has set sufficiently to support its own weight, remove the front form and finish all exposed surfaces.
1. Finish top of curb with a steel trowel.
2. Finish edges with a steel edging tool.

3. Rub formed faces with burlap sack or similar device to produce a uniformly textured surface, free from form marks, honeycomb and other defects.

F. Backfilling Curb: Upon completion of curing period, but not before 7 days has elapsed since pouring the concrete, backfill the curb.

G. Adjusting:
1. Finished curb shall present a uniform appearance for both grade and alignment.
2. Remove curb sections showing abrupt changes in alignment or grade or which are more than 1/4 inch away from location as staked or which are defective for any reason.
3. Construct new curb at Contractor's expense.

3.04 SIDEWALK CONSTRUCTION

A. Thickness of sidewalks shall be as shown on the drawings.

B. Place, process, finish and cure concrete in conformance with this section and the applicable requirements of ACI 614. Where the requirements differ, the more stringent shall govern.

C. Preformed Asphalt Expansion Joints.
1. At maximum intervals of 60 feet.
2. Where sidewalk ends.
3. Around posts, poles or other objects protruding through the sidewalk.
4. Apply joint sealant specified.

D. Contraction Joints:
1. Spacing to match width of sidewalk up to 6 feet wide. For walks over 6 feet wide maximum spacing not to exceed 5 feet.
2. Provide transversely to the walks.
3. Depth to equal 1/4 of thickness of walk.
4. Tool joints into fresh placed concrete. DO NOT SAW CUT JOINTS.

E. Finish:
1. Broom finish with fine hair broom at right angles to length of walk and tool at all edges, joints and markings.
2. Mark walks transversely at intervals shown on drawings with a jointing tool.

3.05 CONCRETE STEPS

A. Rub vertical surfaces smooth and provide light broomed finish on treads. Round edges with steel edging tool and cove juncture of treads and risers.

END OF SECTION 32 13 13

PART 1 - GENERAL

1.01 SUMMARY

A. Paint parking lot lines, letters, directional arrows, island curbs, etc. as shown on the drawings.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, and Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 33 00.
   1. Paint System Data Sheet (PSDS) from paint manufacturer for each system used.
   2. Technical Data Sheets for each product used in the paint system.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Inspection by Architect, or waiver of inspection of any particular portion of the work, shall not be construed to relieve Contractor of his responsibility to perform the work in accordance with these specifications.

1.05 WARRANTY

A. Contractor shall warrant to Owner and guarantee work under this section against defective workmanship and materials for a period of 1 year commencing on the date of final acceptance of the work.

PART 2 - MATERIALS

2.01 TRAFFIC AND ZONE MARKING PAINT

A. Provide Fast Dry Latex Supreme meeting Federal Specification TT-P-1952F, Type I and II as manufactured by RAE Products & Chemicals Corporation, 1-877-275-7550, www.RaePaint.com ,or approved equal offering the following colors:

1. White 9510
2. Yellow 9511
3. Blue 4834
4. Red 5408
5. Black 8512
6. Green 5708

PART 3 - EXECUTION

3.01 GENERAL

A. Paint shall be applied in 2 coats to a clean dry surface using template or a stripping machine. Stripes shall be a uniform width of 4 inches wide. Other markings shall be as shown on drawings.

END OF SECTION 32 17 23