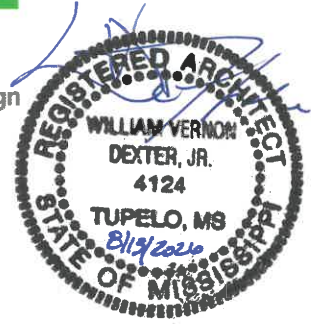




PROJECT MANUAL

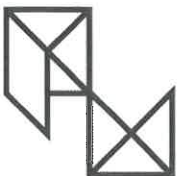
South Tippah School District Tippah County Technical Center Building Addition Ripley, Mississippi ARC Project Number ARC-MS-22325

August 13, 2026

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PROJECT NO. 2024520

SET NO. _____



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SECTION 00 01 06
CONSULTANT LIST AND SEALS

Project	South Tippah School District Tippah County Technical Center Building Addition Ripley, Mississippi ARC Project Number ARC-MS-22325
Owner	South Tippah School District Tony Elliott, Superintendent 402 Greenlee Street Ripley, Mississippi 38663 Telephone: (662) 837-7156 Fax: (662) 837-1362
Architect	PryorMorrow PC Post Office Box 7066 431 West Main Street, Suite 300 (38804) Tupelo, Mississippi 38802-7066 Telephone: (662) 840-8062 Fax: (662) 840-8092
Geotechnical Engineer	Pritchard Engineering, LLC 5227 South Frontage Road Columbus, Mississippi 39701 Telephone: (662) 324-2205 Fax: (662) 324-2092
Structural Engineer	Fowler Engineering LLC 1989 Oak Tree Cove, Suite A Hernando, Mississippi 38632 Telephone: (662) 469-9571 Fax: same
Mechanical and Electrical Engineer	Corbett Legge & Associates, PLLC Post Office Box 7370 431 West Main Street, Suite 101 (38804) Tupelo, Mississippi 38802-7370 Telephone: (662) 844-7114 Fax: (662) 844-7138
Civil Engineer	Engineering Solutions, Inc. 1324 North Veterans Boulevard Tupelo, Mississippi 38804 Telephone: (662) 840-9063 Fax: (662) 840-9064

END OF SECTION

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ADVERTISEMENT FOR BIDS

NOTICE TO BIDDERS

Sealed bids will be received in the office of the South Tippah School District, 402 Greenlee Street, Ripley, Mississippi 38663, until 2:00 p.m. on Tuesday, October 6, 2026, for:

South Tippah School District
Tippah County Technical Center Building Addition
Ripley, Mississippi
ARC Project Number ARC-MS-22325

PryorMorrow Project Number: 2024520

NOTE: Minority and women's business enterprises are solicited to bid on this Contractor as Prime Contractors and are encouraged to make inquiries regarding potential subcontracting.

NOTE: The successful bidder must comply with the Davis-Bacon Act which requires that all laborers and mechanics shall be paid at rates not less than those determined by the Department of Labor to be the prevailing for the locality in which the project is located.

BID DOCUMENTS: Bid documents will be available in original paper copy or in electronic format. Planholders are required to log in and register for an account at www.pryormorrowplans.com to view and order bid documents. All planholders are required to have a valid e-mail address for registration. Bid documents are non-refundable and must be purchased through the website. Any questions regarding website registration, online orders, or electronic bidding should be directed to Plan House Printing at (662) 407-0193.

PRE-BID CONFERENCE: The date, time, and location of the pre-bid conference will be issued via addendum. All planholders are encouraged to attend.

BID SUBMISSION: Bidders may submit a sealed bid as indicated above or may submit an electronic bid in lieu of a sealed bid. Submission of an electronic bid in lieu of a sealed bid shall be submitted at www.pryormorrowplans.com. Electronic bids are not required but are an option.

BID PREPARATION: Bid preparation will be in accordance with Section 00 21 13 – Instructions to Bidders, bound in the Project Manual.

BID GUARANTEE: Proposals shall be submitted with Proposal Security in the form of Certified Check or acceptable Bid Bond in an amount equal to at least five percent (5%) of the base bid; such security is to be forfeited as liquidated damages, not penalty, by any bidder who fails to carry out the terms of the proposal. The Bid Bond, if used, shall be payable to the Owner. Bonds on the project must be received on or before the period scheduled for the project and no bid may be withdrawn after the scheduled closing time for the project. Bids must be firm for a period of forty-five (45) days after the scheduled time of opening.

PERFORMANCE-PAYMENT BOND: A one hundred percent (100%) Performance-Payment Bond issued by a surety company authorized to do business in the State of Mississippi will be required within ten (10) days after the successful bidder has been notified of the award of the contract to him.

CERTIFICATE OF RESPONSIBILITY: All bids submitted by a prime or subcontractor for public works or public projects where said bid is in excess of fifty thousand dollars (\$50,000.00) to perform contracts enumerated in Section 31-3-21, Mississippi Code of 1972, shall contain on the outside or exterior of the envelope or container of such bid the contractor's current certificate number. No bid shall be opened or considered unless such contractor's current certificate number appears on the outside or exterior of said envelope or container or unless there appears a statement on the outside or exterior of such envelope or container to the effect that the bid enclosed therewith does not exceed fifty thousand dollars (\$50,000.00).

NOTE: When bids are submitted electronically, the requirement for including on the exterior of the bid envelope the contractor's current certificate of responsibility number or a statement that the bid enclosed does not exceed fifty thousand dollars (\$50,000.00) shall be deemed fulfilled and the bid in compliance by including the same information as an attachment with the electronic bid submittal.

The Owner reserves the right to reject any or all bids and to waive irregularities.

Publish: Wednesday, September 2, 2026
 Wednesday, September 9, 2026

END OF SECTION

SECTION 00 21 13

INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.01 GENERAL INFORMATION

- A. Should a bidder find discrepancies in or omissions from the drawings or specifications or be in doubt as to their written meaning, the bidder should immediately notify the Architect who will then send a written instruction or interpretation to all known holders of the documents. Neither the Owner nor the Architect will be responsible for oral instructions or any other communications not included in the documents or addenda.
- B. It is understood and agreed that refinement and detailing of the drawings and specifications will occur from time to time. No adjustment in the contract sum or completion date shall be made unless such refinement results in changes to the scope, quality, or function of the work not reasonably inferable or anticipatable. Notwithstanding anything contained in this Contract to the contrary, the Contractor will receive no increase in the contract sum based on the increased cost of the work resulting from change orders or increased cost of any allowance items unless the change required is beyond the scope of the work.
- C. The Contractor shall not use in the project any new materials containing asbestos, asbestos products, polychlorinated biphenyl (PCB), or other toxic substances. If the Contractor discovers that such substances as described herein have been specified or do exist in the project, the Contractor shall promptly notify the Architect in writing and make substitutions for these products at no cost to the Owner.

1.02 METHOD OF BIDDING

- A. Lump sum single bids received from General Contractors for all work shown on the drawings or specified herein.
- B. Bidders may submit a sealed bid or may submit an electronic bid in lieu of a sealed bid. Submission of an electronic bid in lieu of a sealed bid shall be submitted at www.pryormorrowplans.com. Electronic bids are not required but are an option.

1.03 BID DOCUMENTS

- A. Bid documents will be available in original paper copy or in electronic format. Planholders are required to log in and register for an account at www.pryormorrowplans.com to view and order bid documents. All planholders are required to have a valid e-mail address for registration. Bid documents are non-refundable and must be purchased through the website. Any questions regarding website registration, online orders, and electronic bidding should be directed to Plan House Printing at (662) 407-0193.

1.04 PREPARATION OF BID

- A. Condition of work: Each bidder must fully inform himself of the conditions relating to the construction of the project and employment of labor thereon. Failure to do so will not relieve a successful bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his contract.
- B. Examination of site: All bidders, including the General Contractor and subcontractors, will visit the site of the project and inform themselves of all conditions. Failure to visit the site will in no way relieve the successful bidder from furnishing any materials or performing any work required to complete work in accordance with the drawings and the Project Manual without additional cost to the Owner.

1.05 PROPOSALS

- A. Make all proposals on the forms provided and fill in all applicable blank spaces without interlineation, alteration, erasure, or recapitulation of the work to be done.
- B. Oral proposals will not be considered.
- C. Indicate receipt of addenda issued during the bidding on the proposal form.
- D. On the outside of the bid envelope, indicate the following:
 - 1. Name of the company submitting the bid.
 - 2. Certificate of Responsibility number.
 - 3. Project name.
- E. **Provide two (2) duplicate original proposals and two (2) duplicate original bid bonds.**
- F. **The bidder shall provide the following:**
 - 1. **Two (2) duplicate original proposals.**
 - 2. **Two (2) duplicate original bid bonds.**
 - 3. **Two (2) duplicate original Acknowledgement Forms (refer to Section 00 45 00 for said form). NOTE: Two (2) duplicate original Acknowledgement Forms must be provided; if said Acknowledgement Forms are not so provided, the proposal shall be considered non-responsive.**
- G. If the bid is mailed, place the bid envelope inside a second envelope to prevent inadvertent premature opening of the proposal. Indicate on the outside envelope "Bid Enclosed."
- H. Special note regarding a bid that is submitted electronically: A bid submitted electronically shall be deemed in compliance with the requirement for including a Certificate of Responsibility number or a statement that the bid does not exceed fifty

thousand dollars (\$50,000.00) on the exterior of the bid envelope if that same information is included as an attachment with the electronic bid submittal.

1.06 OPENING OF BIDS

- A. Bids will be publicly opened shortly after the time stated in the Advertisement for Bids. Bidders' representatives are invited; however, attendance is not mandatory. If bids cannot be opened at the advertised date and time due to "force majeure" reasons, bids will be received and publicly opened by the next business day that the agency shall be open and at the previously advertised time unless an addendum changing the date and time of the bid opening is issued.

1.07 CERTIFICATE OF RESPONSIBILITY

- A. Each Contractor submitting a bid equal to or in excess of \$50,000.00 must show on his bid and on the face of the envelope containing the bid his Certificate of Responsibility number, as required by Section 31-3-21, Mississippi Code (latest revision) and as required by the Statutory Amendments of the Contractors Act of 1985.
- B. Sufficient evidence that said Certificate of Responsibility has been issued and is in effect at the time of receiving bids must be submitted as required by the Owner and the Architect.
- C. If the submitted bid does not exceed \$50,000.00, a Certificate of Responsibility is not required. If a bidder submits a bid not exceeding \$50,000.00, a notation stating "BID DOES NOT EXCEED \$50,000.00" must appear on the face of the envelope.
- D. Bids without a Certificate of Responsibility number or the notation "BID DOES NOT EXCEED \$50,000.00" will not be opened.

1.08 NON-RESIDENT CONTRACTORS

- A. A non-resident Contractor submitting a bid for a public project in Mississippi must submit a copy of his or her state's policy on non-resident contractors with the bid as required by the Mississippi Code.

1.09 SUBCONTRACTS

- A. The bidder is specifically advised that any proposed subcontractors must be acceptable to the Owner.
- B. Each subcontractor whose portion of the work exceeds \$50,000.00 shall maintain a valid Certificate of Responsibility.
- C. Within five (5) days after the bid opening, the successful bidder shall identify all proposed subcontractors. Indicate the Certificate of Responsibility number for all subcontractors whose portion of the work exceeds \$50,000.00. The bidder assumes the risk that the proposed subcontractors are acceptable to the Owner and shall not make substitutions unless agreed to by the Owner.

1.10 BID SECURITY

- A. Each bid must be accompanied by the bidder's certified check or a bid bond, duly executed by the bidder as principal and having surety thereon, a surety company approved by the Owner and signed by a resident agent in Mississippi, in the amount of five percent (5%) of the Base Bid.
 - 1. When the bid is submitted electronically, the low bidder shall provide to the Architect two (2) original duplicate bid bonds within seventy-two (72) hours of the bid opening. If these original duplicate bid bonds are not received within seventy-two (72) hours of the bid opening, the proposal may be rejected by the Owner as non-responsive.
- B. All bid bonds must be accompanied by an appropriate Power of Attorney designating the Mississippi Resident Agent.
- C. If written acceptance of the bid is mailed, telegraphed, or delivered to the successful bidder within forty-five (45) days after the opening of bids, the bidder shall execute and deliver the specified form of agreement to the Owner within ten (10) days of receiving written acceptance or face forfeiture of the Bid Security. The Bid Security, in the sum of five percent (5%) of the Base Bid amount, shall become the property of the Owner in the event the contract and bond required are not executed within the established time frame. The Bid Security becomes the property of the Owner as liquidated damages for the delay of the project and the additional expense caused to the Owner thereby.
- D. If written acceptance of the bid is mailed, telegraphed, or delivered to the successful bidder after the 45-day deadline and the successful bidder does not withdraw his or her proposal, the bidder shall execute and deliver the specified form of agreement to the Owner within ten (10) days of receiving written acceptance. After forty-five (45) days, the bid bond is not forfeited.

1.11 AWARD OF CONTRACT

- A. The Contract will be awarded on the basis of the lowest and best bid or lowest and best combination of base bid and those alternates, which produce a total within available funds.
- B. The Owner reserves the right to waive irregularities and to reject any or all bids.
 - 1. Irregularities: The omission of any information requested on the bid form may be considered as an informality, or irregularity, by the awarding public body when, in their opinion, the omitted information does not alter the amounts contained in the submitted bid proposal or place other bidders at a disadvantage.
- C. The Owner reserves the right to disqualify and reject the low bidder and make award to other than the low bidder if, in the Owner's judgment, it is in the Owner's best interest. A bidder may be disqualified for:
 - 1. Being in arrears on existing contracts.
 - 2. Being in litigation with the Owner.

3. Having defaulted on or failed to complete satisfactorily a previous contract including warranty obligations.

1.12 NOTICE TO PROCEED

- A. The Contractor shall commence work to be performed under this Agreement on a date to be specified in a written order of Notice to Proceed from the Architect.

END OF SECTION

SECTION 00 25 13
PRE-BID MEETINGS

PART 1 - GENERAL

1.01 PRE-BID CONFERENCE

- A. A pre-bid conference may be held prior to the bid letting. The Architect will notify planholders of the date, time, and location of the pre-bid conference via addendum. All planholders are encouraged to attend.

END OF SECTION

SECTION 00 31 32
GEOTECHNICAL DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. A copy of the Geotechnical Report is enclosed herein (it follows this page).
- B. Related sections:
 - 1. Section 31 10 00 – Site Clearing
 - 2. Section 31 22 13 – Rough Grading
 - 3. Section 31 22 19 – Finish Grading
 - 4. Section 31 23 00 – Excavation and Fill
 - 5. Section 31 25 00 – Erosion and Sedimentation Controls
- C. Any party discovering a conflict between the specifications and the Geotechnical Report shall immediately notify the Architect in writing.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prospective bidders should read and understand the Geotechnical Report before submitting bids or executing the Agreement.

END OF SECTION

GEOTECHNICAL REPORT

Proposed:

**CAREER CENTER ADDITION
TIPPAH COUNTY SCHOOL DISTRICT
RIPLEY, MISSISSIPPI**

Prepared For:

**SOUTH TIPPAH SCHOOL DISTRICT
RIPLEY, MISSISSIPPI**

Submitted To:

**PRYOR MORROW
TUPELO, MISSISSIPPI**

Prepared by:



Project Number: 7875


CLYDE L. PRITCHARD, P.E.

JULY 2026





5227 South Frontage Road
Columbus, MS 39701
(662) 324-2205
pritchardengineeringinc.com

JULY 23, 2026

PRYOR MORROW
WILLIAM DEXTER., AIA
P.O. BOX 7066
TUPELO, MS 38802

VIA EMAIL: wdexter@pryor-morrow.com

RE: GEOTECHNICAL REPORT
CAREER CENTER ADDITION
SOUTH TIPPAH SCHOOL DISTRICT
RIPLEY, MISSISSIPPI

Dear Mr. Dexter:

Pritchard Engineering appreciates the opportunity to participate as geotechnical consultant for the project captioned above. The accompanying report presents field and laboratory methods employed in accumulating data for assessment of the subsurface soils and conditions encountered. All field and laboratory procedures were accomplished in accordance with applicable ASTM standard specifications to ensure quality assurance. A description of the generalized soil stratigraphy is provided. Data generated from this effort was utilized in conjunction with site development information to formulate geotechnical recommendations for site preparation, foundation design, pavements, and construction phase testing.

The recommendations issued are based upon preliminary project information provided by Pryor Morrow. Should the scope of work be altered, we respectfully request an opportunity to assess this geotechnical report in light of the proposed revisions. Feel free to contact us should you have any questions or comments concerning the contents of this report or if we may be of additional service.

Document transmittals:

Pryor Morrow

(1 copy)

via: E-Mail

Respectfully,

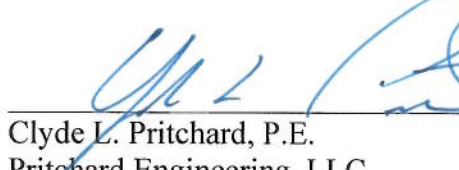

Clyde L. Pritchard, P.E.
Pritchard Engineering, LLC



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CAREER CENTER ADDITION
SOUTH TIPPAAH SCHOOL DISTRICT
RIPLEY, MISSISSIPPI

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GEOTECHNICAL REPORT

PROPOSED

CAREER CENTER ADDITION

SOUTH TIPPAAH SCHOOL DISTRICT

RIPLEY, MISSISSIPPI

PROMPT / AUTHORIZATION

The proposed project involves construction of a new career education building anticipated to be a premanufactured metal building type structure having a footprint of 4640 square feet. The purpose of the geotechnical investigation is to assess the general and physical characteristics of the surface and subsurface soils within the zone of influence and to make recommendations for foundation and pavement design and related construction based upon the results of the investigation. Authorization to proceed was issued by Pryor Morrow on behalf of South Tippah School District in accordance with the Geotechnical Services Proposal offered by Pritchard Engineering, June 26, 2026.

SITE CHARACTERISTICS

The South Tippah Career Center is located at physical address 2560 County Road 501. Ripley, Mississippi. Handheld GPS coordinates obtained by the driller on the site are N 34° 46' 15.9" and W 88° 55' 10.9". Ground cover consists primarily of routinely mowed grasses. The site topography is gently undulating, and surface drainage appeared adequate. Photos depicting the property at the time of field exploration are presented as Appendix (D).

FIELD INVESTIGATION

Prior to drilling, utility locations were identified through the services of the Mississippi One Call System and representatives of South Tippah School District.

Seven (7) borings were performed at locations selected by Pritchard Engineering with consideration of the conceptual site plan developed and provided by Pryor Morrow. Field staking of boring locations was accomplished and documented utilizing GPS coordinates. Appendix (C) provides a site schematic illustrating boring locations with respect to the project limits and site plan.

Drilling was accomplished by the dry auger method utilizing continuous flight auger advanced by a tractor mounted Giddings Model TS-35 hydraulic boring rig. Borings performed in proximity of the future building were terminated at a depth of fifteen (15) feet below the existing site elevation. Depth of drilling in proximity of the proposed access drives and paving was five (5) feet. Shelby tubes were advanced (See ASTM D-1587) at selected depths to provide “undisturbed” specimens for visual classification and determination of shear strength by testing in unconfined compression. Standard penetration tests (See ASTM D-1586) were also conducted at locations and intervals specified by the geotechnical engineer. The standard penetration resistance (N) value is the number of blows required to drive a standard 18-inch split-barrel samples the final 12 inches utilizing a 140-pound hammer and a freefall height of 30 inches. Standard penetration values provide an indication of soil consistency and are utilized in formulating design recommendations through empirical relations including but not limited to bearing capacity and potential settlement under loading conditions. “N” values are depicted by depth and location on the boring logs.

Representative specimens of the various soils encountered were retrieved at changes in strata and at intervals not exceeding 2 feet in depth. Samples retrieved during the field investigation were immediately placed in sealed containers to preserve their physical characteristics for transportation and future analysis in the laboratory.

The depth at which highly saturated soils or free water was first detected during drilling is indicated on the boring logs. Prior to closure, the depth to ground water and/or borehole caving was determined. This information is also recorded on the boring logs and was obtained after an elapsed period of approximately 0.5 to 2.0 hours.

LABORATORY ANALYSIS

Procedures employed in performing laboratory analysis were accomplished in general accordance with applicable American Society for Testing and Materials (ASTM) standard specifications for quality assurance. Tests were conducted on representative samples of the various soils encountered as designated by the Engineer. A synopsis of the tests performed including a summary of the results obtained is presented as follows:

(Soil Classification) – ASTM D-2487

All soil samples were classified both visually and in accordance with criteria stipulated by the Unified Soil Classification System. (See boring logs.) Under the Unified Soil Classification System, coarse-grained soils (gravels and sands) are classified based upon grain-size. Fine-grained materials (silts and clays) are classified on the basis of plasticity (PI) as related to the Casagrande “A” line. For your convenience, a description of the symbols employed by the

Unified Soil Classification and their meaning is presented as Appendix (A). Where appropriate, dual symbols are employed to signify borderline soils.

(Water Content) – ASTM D-2216

In-situ (or field) moisture contents were determined by placing extracted samples in sealed containers immediately upon removal from the drill cavity. Field moisture contents are valuable in assessing the general subsurface conditions and in evaluating the magnitude of volume change, which might be anticipated in soils having a high shrink-swell potential. Also, the degree of wetting or drying which may be required to achieve moisture contents approaching optimum for soils involved in site grading may be estimated. Information generated from the analysis performed indicates in-situ moisture contents are within the anticipated range for the soil types encountered and climatic season. Moisture content data is presented on the boring logs as W (%).

(Liquid and Plastic Limits) – ASTM 4318

Liquid and plastic limits, commonly referred to as Atterburg Limits, were performed on representative samples of the cohesive soils encountered. The plastic limit (PL) is the moisture content representing the lower boundary range of plastic behavior of a soil. The liquid limit (LL) is the moisture content representing the upper range of plastic behavior; above which a soil will essentially have the shear strength of a fluid. Both values are expressed as percent (%) moisture. The plasticity index (PI) is the numerical difference between the liquid limit and plastic limit and is utilized in soil classification and empirical relations developed regarding volume change, strength, and permeability. Typically, soils exhibiting a high PI are susceptible to significant changes in volume (i.e. shrinkage and swelling) with fluctuations in moisture content and

experience a severe loss of shear strength upon saturation. Low PI soils are relatively inactive with respect to moisture induced volume change and are normally suitable as a supporting subgrade soil. Data generated from this investigation indicates the plasticity index (PI) of the clays identified within the upper soil horizon ranges from 26 to 77. Based on this information the higher plasticity “CH” soils are considered to have a moderate to **very high** shrink-swell potential which should be considered in the design and construction of the proposed structure and related improvements. Liquid limit (LL) and PI results are also depicted by sample depth on the boring logs.

(Grain-Size Analysis) – ASTM D-422

Mechanical grain-size analysis provides the particle size distribution of the various constituents comprising the soil mass. Where necessary, this procedure may be complimented by the hydrometer test (ASTM D-422) to provide delineation of the silt and clay fractions. Results of these tests are used in classifying soils in accordance with the Unified Soil Classification System and in estimating the California Bearing Ratio (CBR), modulus of subgrade reaction (k), and permeability from empirical relations developed with respect to grain size. Specimens retrieved from the borings performed were classified visually and on the basis of plasticity and no grain-size analysis were required.

(Shear Strength)

Shear strength tests were performed on undisturbed and remolded specimens of the various soils encountered. Methods employed in assessing shear strength were designated by the geotechnical engineer and are briefly summarized as follows:

➤ **(Pocket Penetrometer)**

Selected cohesive soil specimens were tested utilizing a pocket penetrometer. This procedure allows for a quick approximation of the unconfined compressive strength of a soil through correlation of penetration of a calibrated plunger. Results are indicated as tons per square foot (tsf) by sample depth on the boring logs and represent the average of a minimum of four (4) readings per specimen.

➤ **(Unconfined Compression Test) – ASTM 2166**

The unconfined compression test provides a relatively quick and economical approximation of the unconsolidated and undrained shear strength of a cohesive soil. Testing involves subjecting an “undisturbed” cylindrical sample of the soil (usually extracted from a Shelby tube) to a uniformly increasing load under controlled stress or controlled strain conditions until failure is reached through shear or excessive strain. The cohesive shear strength (c) is equivalent to one-half of the maximum normal stress realized during the test effort. Specimens retrieved from the borings performed sustained maximum normal loads of 5.8 to in excess of 12.0 kips (1,000 pounds) per square foot of contact area. Test results are presented as unconfined compressive strength on the boring logs.

SOIL PROFILE

The generalized soil profile presented is based upon engineering interpretation of the boring logs and related laboratory analysis as presented in Appendix (B).

Prevalent near surface soils identified at the locations investigated consist of medium to high plasticity silty clays. According to the criteria stipulated by the Unified Soil Classification System these soils are classified CL, CH, or borderline case thereof. High plasticity "fat" clay also conforming to Unified Classification CH was intercepted at depths of approximately 2 to 6.5 feet. This material is considered to have a very high shrink-swell potential and a poor supporting subgrade for structures or paving. Consistency of the various clay strata comprising the overburden as estimated by the driller and verified by standard penetration resistance "N" values of 16 to 25 is typically very stiff.

The soils described are underlain by medium plasticity sandy silty clay(s), (Unified Classification CL or CL-CH) initially intercepted at depths of approximately 12 to 13 feet which extended to the limits of exploration.

ASCE 7-22 is the nationally adopted loading standard for general structural design. Table 20.2-1 Site Classification of the referenced standard provides for definition of Seismic Site Class based on calculated shear wave velocity of the upper 30 meters of the soil profile using measured or estimated shear wave data. Based upon the information generated from this investigation, local geology, and/or published shear wave information, the subject property is assigned CD (dense sand or very stiff clay).

No free water was detected as the borings were advanced. Examination of the drill cavities 0.5 to 2 hours subsequent to removal of the drill tool revealed groundwater at depths of approximately 11.3 to 14.3 feet which corresponds with the lower more sandy deposits. The reader is advised the field investigation was accomplished within a period of near normal precipitation. Migration of groundwater is common above and along fat clay contacts and the phreatic surface is anticipated

to fluctuate with the climatic season. Also, localized abnormalities in groundwater levels may result from random fill or subterranean utility installations.

FOUNDATION RECOMMENDATIONS

It is our understanding the project involves construction of a single-story career educational building anticipated to be a premanufactured metal frame structure having a footprint of 4640 square feet. A site grading plan depicting the desired finish floor elevation has not been provided at the time of this report. This investigation has revealed the near surface in-situ soils to include high plasticity clays with a moderate to very high potential for volume change.

Successful foundation performance within active soils may be accomplished by either 1) selective grading to mitigate the problem soil(s) through removal, or 2) provision of sufficient overburden to insulate the structure and minimize swelling through over-burden pressure, or 3) utilization of a deep foundation system bearing within suitable materials beneath the zone of seasonal volume change.

Based upon comprehensive evaluation of the information generated we recommend provision of a minimum of 5 feet of select imported fill within an area beneath and extending a minimum of 6 feet beyond the perimeter of the future building. The select fill blanket may be accomplished by over-excavation and removal of the on-site soils, filling above the existing topography, or combination of cut and fill. The intent is to minimize the potential for adverse or differential movement by providing a relatively homogeneous blanket of similar processed and compacted materials within the area described.

Having accomplished the above, it is our opinion the structure may be adequately supported by a monolithically cast slab on grade type shallow foundation system consisting of **very stiff** reinforced concrete continuous beam type footings beneath the structure perimeter and load-bearing walls with reinforced concrete spread footings provided as necessary to support concentrated column loads. Recommendations provided for this foundation system are contingent upon earthwork completed in strict accordance with Section EARTHWORK / GRADING.

(Continuous and Spread Footings)

Provided the earthwork is accomplished as specified, continuous foundation components may be designed for a maximum net allowable soil bearing pressure of 3000 pounds per square foot of contact area (psf). Recommended depth of bearing for continuous foundation components is a minimum of 16 inches beneath the finish subgrade elevation. The maximum allowable soil pressure for reinforced concrete spread footings bearing a minimum of 16 inches beneath the finish subgrade elevation is 3600 psf. All foundation members should be adequately reinforced to resist differential movement and as stipulated by applicable American Concrete Institute (ACI) specifications.

The allowable pressures quoted herein are intended to provide a factor of safety of 3.0 to 4.0 with respect to ultimate or bearing capacity failure of the supporting soils with a maximum anticipated settlement of 0.4 inches which is contingent upon proper placement and compaction of soils imported or relocated during the grading process. (See EARTHWORK / GRADING.) Maximum anticipated differential settlement between adjacent columns is 0.2 inches. In the event the structural system will not tolerate the settlement conditions described, we respectfully request an opportunity to review the recommendations cited herein.

(Floor Slabs)

The floor slab is expected to be underlain by processed and compacted select imported fill.

Preparation of the supporting subgrade and base as outlined herein should result in a modulus of subgrade reaction (k) of 110 pci. Floor slabs should be designed in accordance with ACI 302.1R-96 "Guide for Concrete Floor and Slab Construction." We recommend a minimum of 4 inches of coarse aggregate conforming to Mississippi Department of Transportation (MDOT) Size No. 57 or No. 67 gravel or stone be provided beneath the slab to serve as a capillary break and to provide for base tolerance "fine grading."

EARTHWORK / GRADING

All excavations should be performed under the direction of a designated competent person in strict accordance with applicable provisions of the OSHA Excavation Standard. Erosion control measures should be incorporated in accordance with an approved Stormwater Pollution Prevention Plan. At the outset of construction, we advise adequate weep and diversion ditches be installed to provide for storm water control during the grading process. Subsequent to clearing and demolition, any remaining grasses and humus matter should be removed with topsoil stockpiled as needed for future use. Receiving subgrades should be scarified to a minimum depth of 8 inches and compacted to a minimum of 95% of maximum dry density as determined by standard proctor (ASTM D-698).

Subgrade soils should be maintained in a moist condition prior to placement of fill materials.

We advise the prepared subgrade to be inspected by a representative of the geotechnical engineer and that no unauthorized over-excavation be permitted. Should anomalies or differing conditions be revealed in site preparation the geotechnical engineer should be

contacted immediately. Mitigation of any soft or unsuitable materials revealed during construction should be at the expressed direction of the geotechnical engineer.

Where fill is to be superimposed on sloping topography, we advise the receiving slope to be benched at intervals of five (5) feet horizontal and vertical to minimize the potential for shear planes within the soil mass and enhance slope stability.

On-site soils may be relocated to accomplish design elevations, subject to the following restrictions:

- Soils conforming to Unified Classification CH are not to be located as supporting fill within 5 feet of the finish subgrade elevation of proposed structures.
- Soils conforming to Unified Classification CH are not to be located as supporting fill within 3 feet of the finish subgrade elevation of proposed paving.

Unless otherwise specified, imported soils required beneath the structure and paving should consist of select lean clay or clayey sand materials conforming to Unified Soil Classifications SC or CL and exhibiting a plasticity index (PI) of 10 to 18. Relocated or imported soils should be placed in maximum loose lifts of 8 inches compacted to a minimum of 95% of maximum dry density established by standard proctor (ASTM D-698). Where compaction of fill or backfill cannot be accomplished utilizing conventional machinery such as for utility trenches or retaining walls the maximum loose lift thickness should not exceed 4".

Moisture content of all soils should be maintained at or above the laboratory optimum.

Depending on the season in which grading is accomplished, it may be necessary to aerate and dry

or supplement moisture into the soils utilized in construction to achieve the specified moisture levels.

The geotechnical design criteria and recommendations presented are contingent upon materials and workmanship compliant with specifications presented herein intended to ensure successful foundation and pavement performance. Quality assurance testing of earthwork, cast-in-place concrete, and asphalt is recommended to supplement Contractor quality control efforts. Pritchard Engineering believes this service is best sponsored by the Owner or end user with reporting to the project professional. We advise field moisture-density tests be performed during construction to ensure compaction and moisture criteria are satisfied utilizing a nuclear device in accordance with ASTM D-2922. Construction phase testing should be conducted by certified technician(s) under the direction of a registered engineer. With consideration of the estimated volume of earthwork required, we advise all compaction reports to be identified with respect to location and lift sequence/elevation.

Recommended minimum test frequencies are:

- 1 test per 2000 square feet of prepared subgrade beneath structure or paving

- 1 test per 2000 square feet per 8-inch loose lift of relocated or imported fill beneath structures or paving

- (minimum 3 tests / lift beneath building)

- 1 test per 2000 square feet of prepared subbase or base beneath pavements

- 1 test per 50 linear feet per lift of utility trench backfill.

* Where construction activities disturb supporting subgrades, these areas should be re-evaluated or tested prior to final improvements.

PAVEMENTS

Effective pavement design requires evaluation of the nature and frequency of vehicular traffic imposed and the characteristics of the supporting (design) soils. Also, pavement serviceability and maintenance are considered in conjunction with local availability of materials utilized to construct the pavement structure(s).

No information regarding traffic loading was available at the time of this report. The anticipated design traffic consists of moderate repetitions of passenger cars and light passenger trucks.

Additional traffic loading may include routine product deliveries and disposition of trash by waste management trucks. Rigid and flexible pavement alternates are prepared for both light- and heavy-duty traffic areas.

The in-situ soils are designated as design subgrade. Based upon the information generated from this investigation, these soils primarily consist of medium to high plasticity silty clays and clays conforming to Unified Classifications CL, CH, or borderline case thereof. Empirical relations developed by the Mississippi Department of Transportation (MDOT), which consider grain-size and plasticity indicate these soils, have an estimated California Bearing Ratio (CBR) of 3 to 7. The estimated modulus of subgrade reaction (k) ranges from approximately 50 to 90 pci. The CBR and K values provide indices representative of soil support for flexible and rigid pavements, respectively.

The pavement structures recommended herein are developed based upon the design criteria stipulated above and satisfactory completion of earthwork as defined in Section EARTHWORK / GRADING.

FLEXIBLE PAVEMENT(S)

(Light-Duty)

- Subgrade: 18” minimum processed select imported fill compacted to a minimum of 95% of maximum dry density as defined by ASTM D-698.
- Subbase: 6” minimum crushed limestone meeting MDOT specifications for Size 610 aggregate. Compact to a minimum of 98% of maximum dry density as defined by ASTM D-698.
- Base: 2.0” minimum hot mixed bituminous base course conforming to MDOT standard specifications for Type MT-19mm or BB-1 material.
- Surface: 1.5” minimum hot mixed bituminous surface course conforming to MDOT standard specifications for Type MT – 9.5 mm or SC-1 material.

(Heavy-Duty)

- Subgrade: 18” minimum processed select imported fill compacted to a minimum of 95% of maximum dry density as defined by ASTM D-698.

- Subbase: 6” minimum crushed limestone meeting MDOT specifications for Size 610 aggregate. Compact to a minimum of 98% of maximum dry density as defined by ASTM D-698.
- Base: 4.0” minimum hot mixed bituminous base course conforming to MDOT standard specifications for Type MT-19 mm or BB-1 material.
- Surface: 2.0” minimum hot mixed bituminous surface course conforming to MDOT standard specifications for Type MT-9.5 mm or SC-1 material.

RIGID PAVEMENT

(Light-Duty)

- Subgrade: 18” minimum processed select imported fill compacted to a minimum of 95% of maximum dry density as defined by ASTM D-698.
- Base: 4” minimum crushed limestone meeting MDOT standard specifications for Size 610 material. Compact to a minimum of 98% of maximum dry density as defined by ASTM D-698.
- Surface: 5.0” Non-reinforced Portland Cement Concrete Pavement.

(Heavy-Duty)

- Subgrade: 18" minimum processed select imported fill compacted to a minimum of 95% of maximum dry density as defined by ASTM D-698.
- Base: 4" minimum crushed limestone meeting MDOT standard specifications for Size 610 aggregate. Compact to a minimum of 98% of maximum dry density as defined by ASTM D-698.
- Surface: 6.0" Reinforced Portland Cement Concrete Pavement.

Rigid (concrete) pavements should be constructed in accordance with applicable provisions of the American Concrete Institute (ACI) and Portland Cement Association (PCA). Concrete utilized in paving should exhibit a minimum 28-day compressive strength of 3,500 psi and contain approximately 5% of entrained air. Pavement jointing should consist of keyed construction joints, expansion joints, and tooled or sawn crack control joints as recommended by the PCA. All joints should be sealed to prevent migration of surface water and fuel spills into the subbase.

LANDSCAPING

The designer should be aware that any condition that contributes to wetting and drying of the subgrade may result in adverse volume change or prove otherwise detrimental to foundation or pavement systems. Expeditious removal of surface and stormwater is critical. Irrigation systems should be well-drained. Gutters are advised for removal of roof water. Also, the dripline of large water consuming trees and large variety evergreen shrubs should not be located within 30 feet of the proposed structure.

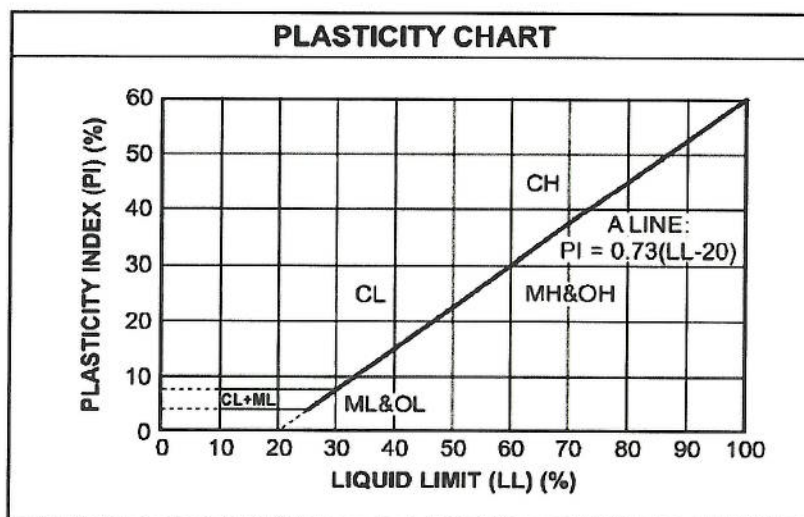
APPENDIX (A)

UNIFIED SOIL CLASSIFICATION SYSTEM

Appendix (A)

Major Divisions			Group Symbol	Typical Names	Classification for Coarse-Gained Soils	
Coarse-Grained Soils (more than half of material is larger than No. 200 sieve)	Gravels (more than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = D_{60} / D_{10} > 4$ $C_c = 1 < D_{30}^2 / D_{10} \times D_{60} < 3$	
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures	Atterburg limits below A line or $I_p < 4$	Above A line with $4 < I_p < 7$ are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterburg limits below A line or $I_p > 7$	
	Sands (more than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = D_{60} / D_{10} > 6$ $C_c = 1 < D_{30}^2 / D_{10} \times D_{60} < 3$	
			SP	Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (appreciable amount of fines)	SM	Silty sands, sand-silt mixtures	Atterburg limits below A line or $I_p < 4$	Limits plotting in hatched zone with $4 < I_p < 7$ are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterburg limits below A line or $I_p > 7$	
Fine-grained soils (more than half of material is smaller than No. 200 sieve)	Silts and clays (liquid limit < 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Determine percentages of sand and gravel from grain-size curve. 2. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP More than 12% - GM, GC, SM, SC 5% to 12% - Borderline cases requiring dual symbols		
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
		OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (liquid limit > 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic soils			
		CH	Inorganic clays of high plasticity, fat clays			
		OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils	Pt	Peat and other highly organic soils	Soil Consistency Clays		

- Determine percentages of sand and gravel from grain-size curve.
- Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows:
Less than 5% - GW, GP, SW, SP
More than 12% - GM, GC, SM, SC
5% to 12% - Borderline cases requiring dual symbols



Soil Consistency	
Clays	
Blows per foot (N)	Consistency
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
Over 30	Hard
Sands	
Blows per foot (N)	Density
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Over 50	Very Dense



APPENDIX (B)

BORING LOGS



PROJECT NO. 7875 G-22
SOUTH TIPPAAH SCHOOL DISTRICT
CAREER CENTER ADDITION
RIPLEY, MISSISSIPPI

BORING NO. 1
 ELEVATION
 DRILLED 07/09/26
 DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _u (tsf)
0											
1			Reddish brown silty <u>CLAY</u>	V. Stiff		20	44	26		CL	
2											
3	2-3.5	X	Reddish brown & gray silty <u>CLAY</u>	V. Stiff	21	22	56	38		CH	2.9
4											
5	5-6.5	X		V. Stiff	25	21	60	40		CH	4.5
6											
6.5											
7			Dark red & gray <u>CLAY</u>	V. Stiff		27				CH	
8											
9				V. Stiff		46				CH	
10											
11	10-11.5	X		V. Stiff	17	58	117	82		CH	
12											
13				V. Stiff		44				CH	
14			Reddish brown fine sandy silty <u>CLAY</u>	V. Stiff		28				CL-CH	
15			BORING TERMINATED								
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)

☐ DRY AUGER.....ASTM D-1452
☐ SHELBY TUBE.....ASTM D-1582
☒ PENETRATION TEST.....ASTM D-1586

WATER OBSERVATION (S)

NONE ENCOUNTERED
14.3 FT. AFTER 1.5 HRS.
 BOREHOLE CAVED AT _____ FT.



PROJECT NO. 7875 G-22
SOUTH TIPPAAH SCHOOL DISTRICT
CAREER CENTER ADDITION
RIPLEY, MISSISSIPPI

BORING NO. 2
 ELEVATION
 DRILLED 07/09/26
 DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _u (tsf)
0											
1			Brown & light gray silty <u>CLAY</u>	V. Stiff		20				CL	
2											
3				V. Stiff		19	46	27		CL	2.9
4											
5				V. Stiff		23				CL	
6			Dark red & gray <u>CLAY</u>	V. Stiff		27				CH	
7											
8				V. Stiff		27				CH	
9											
10				V. Stiff		30				CH	
11											
12				V. Stiff		30				CH	
13			Reddish brown & gray sandy silty <u>CLAY</u>	V. Stiff		27				CL	
14											
15			BORING TERMINATED	V. Stiff		24				CL	
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)

☐ DRY AUGER.....ASTM D-1452
☐ SHELBY TUBE.....ASTM D-1582
☒ PENETRATION TEST.....ASTM D-1586

WATER OBSERVATION (S)

NONE ENCOUNTERED
14.2 FT. AFTER 0.5 HRS.
 BOREHOLE CAVED AT _____ FT.



PROJECT NO. 7875 G-22
SOUTH TIPPAAH SCHOOL DISTRICT
CAREER CENTER ADDITION
RIPLEY, MISSISSIPPI

BORING NO. 3
 ELEVATION
 DRILLED 07/09/26
 DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _u (tsf)
0											
1			Brown & light gray silty <u>CLAY</u>	V. Stiff		21				CL	
2											
3				V. Stiff		20				CL	
4											
5				V. Stiff		24				CL	
6			Dark red & gray <u>CLAY</u>	V. Stiff		44	96	77		CH	3.7
7											
8				V. Stiff		56				CH	
9											
10				V. Stiff		47				CH	
11											
12			Fine sandy below 12'	V. Stiff		34				CH	
13											
14				V. Stiff		30				CH	
15			BORING TERMINATED								
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)

☐ DRY AUGER.....ASTM D-1452
☐ SHELBY TUBE.....ASTM D-1582
☒ PENETRATION TEST.....ASTM D-1586

WATER OBSERVATION (S)

NONE ENCOUNTERED
13.8 FT. AFTER 1.0 HRS.
 BOREHOLE CAVED AT FT.



PROJECT NO. 7875 G-22
 SOUTH TIPPAAH SCHOOL DISTRICT
 CAREER CENTER ADDITION
 RIPLEY, MISSISSIPPI

BORING NO. 4
 ELEVATION
 DRILLED 07/09/26
 DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _a (tsf)
0											
1			Brown & light gray silty <u>CLAY</u>	V. Stiff		22				CL	
2											
3	2-3.5	X	Dark red & gray <u>CLAY</u>	V. Stiff	24	24	55	33		CH	4.5
4											
5	5-6.5	X		V. Stiff	18	24	62	40		CH	3.9
6											
7				V. Stiff		30				CH	
8											
9				V. Stiff		43				CH	
10			Fine sandy below 10'								
11	10-11.5	X		V. Stiff	22	42	61	31		CH	2.5
12											
13				V. Stiff		38				CH	
14			Reddish brown & gray sandy silty <u>CLAY</u>	V. Stiff		22				CL	
15			BORING TERMINATED								
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)

☐ DRY AUGER.....ASTM D-1452
☐ SHELBY TUBE.....ASTM D-1582
☒ PENETRATION TEST.....ASTM D-1586

WATER OBSERVATION (S)

NONE ENCOUNTERED
11.3 FT. AFTER 1.5 HRS.
 BOREHOLE CAVED AT _____ FT.



PROJECT NO. 7875 G-22
SOUTH TIPPAAH SCHOOL DISTRICT
CAREER CENTER ADDITION
RIPLEY, MISSISSIPPI

BORING NO. 5
ELEVATION
DRILLED 07/09/26
DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _u (tsf)
0											
1			Brown & light gray silty <u>CLAY</u>	V. Stiff		21				CL	
2											
3				V. Stiff		21				CL	
4											
5			BORING TERMINATED	V. Stiff		23				CL-CH	
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)

☐ DRY AUGER.....ASTM D-1452
☐ SHELBY TUBE.....ASTM D-1582
☒ PENETRATION TEST.....ASTM D-1586

WATER OBSERVATION (S)

NONE ENCOUNTERED ☒ X
_____ FT. AFTER _____ HRS.
BOREHOLE CAVED AT _____ FT.



PROJECT NO. 7875 G-22
SOUTH TIPPAAH SCHOOL DISTRICT
CAREER CENTER ADDITION
RIPLEY, MISSISSIPPI

BORING NO. 6
ELEVATION _____
DRILLED 07/09/26
DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _u (tsf)
0											
1			Brown & light gray silty <u>CLAY</u>	V. Stiff		20				CL	
2											
3				V. Stiff		20	44	26		CL	3.0
4											
5			BORING TERMINATED	V. Stiff		22				CL	
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)☐ DRY AUGER.....ASTM D-1452☐ SHELBY TUBE.....ASTM D-1582☒ PENETRATION TEST.....ASTM D-1586**WATER OBSERVATION (S)**NONE ENCOUNTERED ☒ X

_____ FT. AFTER _____ HRS.

BOREHOLE CAVED AT _____ FT.



PROJECT NO. 7875 G-22
SOUTH TIPPAAH SCHOOL DISTRICT
CAREER CENTER ADDITION
RIPLEY, MISSISSIPPI

BORING NO. 7
ELEVATION _____
DRILLED 07/09/26
DRILLER HV

DEPTH (FT)	SAMP (FT)	SR	VISUAL CLASSIFICATION / REMARKS	CONSIST.	SPT (N)	w %	LL	PI	-200 %	UNIFIED CLASS	q _u (tsf)
0											
1			Brown & light gray silty <u>CLAY</u>	V. Stiff		22				CL-CH	
2											
3	2-3.5	X	Dark red & gray <u>CLAY</u>	V. Stiff	16	18	70	47		CH	6.0+
4											
5			BORING TERMINATED	V. Stiff		30				CH	
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

SAMPLE RETRIEVAL (SR)

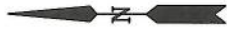
☐ DRY AUGER.....ASTM D-1452
☐ SHELBY TUBE.....ASTM D-1582
☒ PENETRATION TEST.....ASTM D-1586

WATER OBSERVATION (S)

NONE ENCOUNTERED ☒
_____ FT. AFTER _____ HRS.
BOREHOLE CAVED AT _____ FT.

APPENDIX (C)

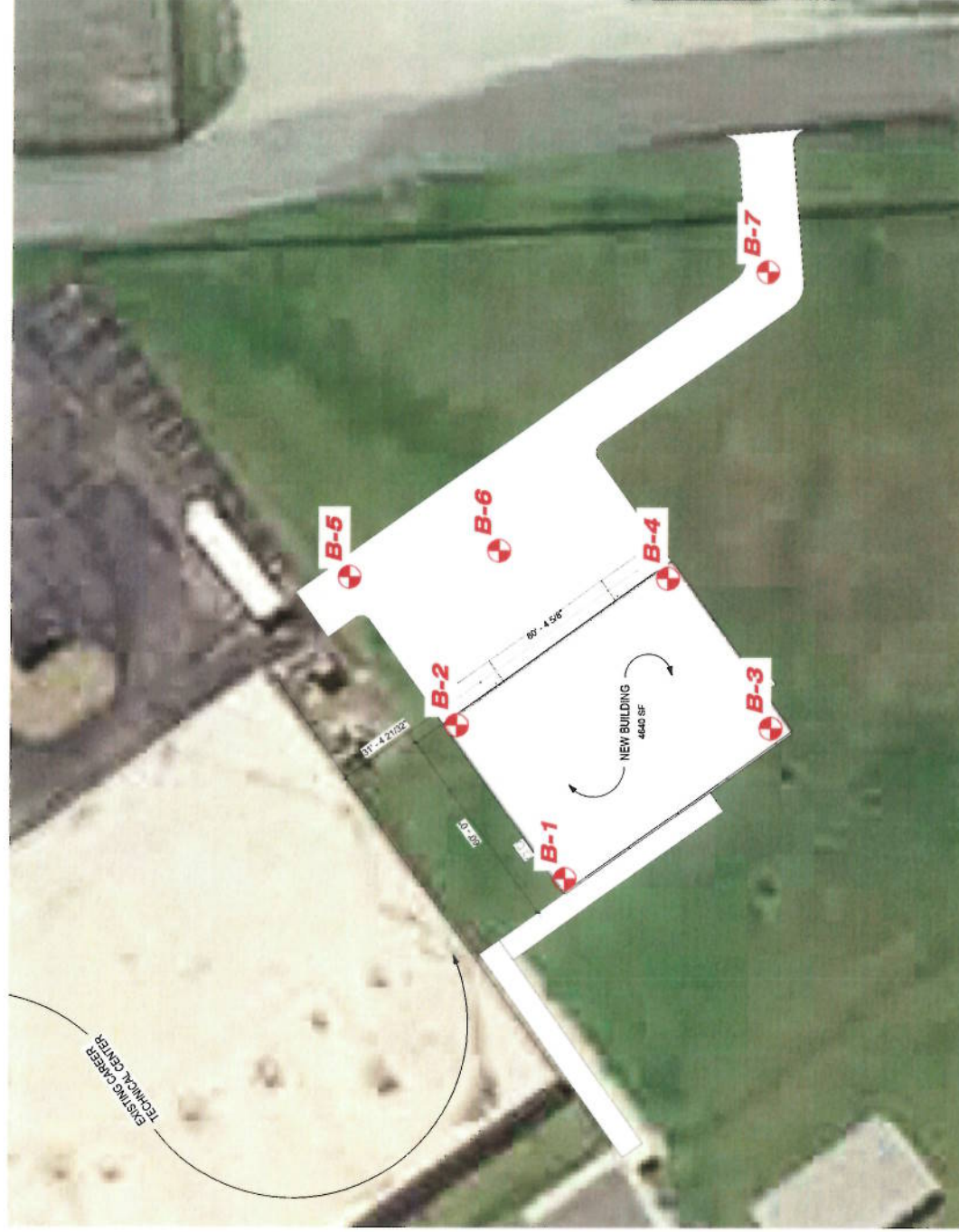
SITE SCHEMATIC / BORING PLAN



SCALE: 1" = 50'



LEGEND



DRAWN BY:	JCM
CHECKED BY:	CLP
DATE:	7/23/2026
SCALE:	1" = 50'
PROJ. #:	7875G-22-26
DWG #:	7875 BP

BORING PLAN
SOUTH TIPPACH SCHOOL DISTRICT
TIPPACH CAREER & TECHNOLOGY CENTER ADDITION
TIPPACH COUNTY, MISSISSIPPI
FOR
PRYORMORROW
TUPELO, MISSISSIPPI



PRITCHARD
ENGINEERING

5227 S. FRONTAGE RD.
COLUMBUS, MS 39701
662.324.2205

APPENDIX (D)

PHOTOS





SECTION 00 41 13
BID FORM

Tuesday, October 6, 2026

Certificate of Responsibility Number: _____

Proposal of: _____

Project: South Tippah School District
Tippah County Technical Center
Building Addition
Ripley, Mississippi
ARC Project Number ARC-MS-22325

Owner: South Tippah School District
402 Greenlee Street
Ripley, Mississippi 38663

The receipt of the following Addenda to the Contract Documents is hereby acknowledged:

Addendum No. ____ Date _____ Pages: ____	Addendum No. ____ Date _____ Pages: ____
Addendum No. ____ Date _____ Pages: ____	Addendum No. ____ Date _____ Pages: ____
Addendum No. ____ Date _____ Pages: ____	Addendum No. ____ Date _____ Pages: ____

Having carefully examined the Contract Documents entitled *South Tippah School District, Tippah County Technical Center Building Addition*, prepared by PryorMorrow PC, and dated August 13, 2026, as well as the premises and conditions affecting the work, the undersigned proposes to furnish all labor, materials, and services required by the Contract Documents for the work described as follows:

BASE BID: Construction of a career tech addition and associated site work as indicated.

_____ DOLLARS (\$ _____)

ALTERNATES:

ALTERNATE NUMBER 1: Asphalt paving of new parking area and drive in lieu of limestone paving.

ADD _____ DOLLARS (\$ _____)

ALTERNATE NUMBER 2: Furnish and install the electric generator for the career tech addition.

ADD _____ DOLLARS (\$ _____)

SUBSTANTIAL COMPLETION: Time is an important consideration on the project. The project shall be substantially complete on or before Friday, July 16, 2027.

LIQUIDATED DAMAGES: The Owner will deduct \$300.00 per day liquidated damages for each day of delay exceeding the contract time until such time substantial completion is reached.

CHANGES TO THE WORK: The cost or credit to the Owner resulting from a change in the work shall be determined by mutual acceptance of a lump sum representing the Contractor’s cost of the work (which is properly itemized and supported by sufficient substantiating data to permit evaluation) and a fixed percentage fee. The undersigned acknowledges a fixed percentage fee of fifteen percent (15%) for changes that add to, or increase, the scope of work and five percent (5%) for changes that reduce the scope of work. Refer to Section 00 73 00, 7.3.11.

The Contractor represents that it has (1) examined all available records and data furnished by the Owner and the Architect and has from such examination informed itself fully concerning all surface conditions in connection with the work and the services to be performed hereunder, (2) determined that the site of the work is satisfactory in all respects for the work, and (3) read the Contract Documents and is fully cognizant of and is familiar with all of the terms and conditions thereof.

Respectfully Submitted:

Signed: _____
Print Name: _____
Title: _____
Address: _____

*If the bidder is a corporation, write the State of Incorporated under the signature. If the bidder is a partnership, show the names of all partners.

Note: The bidder’s Certificate of Responsibility number is required on the outside of the envelope that contains the proposal of the bidder.

END OF SECTION

SECTION 00 45 00
REPRESENTATIONS AND CERTIFICATIONS

PROJECT NAME: **South Tippah School District**
 Tippah County Technical Center Building Addition
 Ripley, Mississippi
 ARC Project Number ARC-MS-22325

PROJECT NUMBER: **2024520**

I, the undersigned Contractor, do hereby acknowledge the following with the reference to this project:

- A. This project will result in a contract being issued that will use funds from the sources referenced in this specification, specifically funds from the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program.
- B. I will, to the extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the US (including, but not limited to iron, aluminum, steel, cement, and other manufactured products).
- C. I will abide by and comply with all requirements and provisions of the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program.
- D. Equal Employment Opportunity: I will abide by and comply with all requirements of the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."
- E. Davis-Bacon Act, as amended (40 U.S.C. 3141-3148): I will abide by and comply with all requirements of the Davis-Bacon Act as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction"). I understand that, in accordance with the statute, I will be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, I will be required to pay wages not less than once a week. I acknowledge the current prevailing wage determination issued by the Department of Labor as shown in Appendix "A" of the specifications (Project Manual).
- F. Copeland "Anti-Kickback" Act (40 U.S.C. 3145): I will abide by and comply with the Copeland "Anti-Kickback" Act as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). Each

contractor or subrecipient is prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

- G. Byrd Anti-Lobbying Amendment (31 U.S.C. 1352): I will abide by and comply with the Byrd Anti-Lobbying Amendment. As a contractor applying or bidding for an award exceeding \$100,000.00, I acknowledge that I must file the required certification. I understand that each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352 and that each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures shall be forwarded from tier to tier up to the non-Federal award.
- H. Debarment and Suspension (Executive Orders 12549 and 12689): I will abide by and comply with Executive Orders 12549 and 12689 as it pertains to debarment and suspension. I acknowledge that a contract award (see 2 CFR 180.220) shall not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.
- I. Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended: I will abide by and comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act and the Federal Water Pollution Control Act. I acknowledge that violations shall be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).
- J. Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708) as supplemented by Department of Labor regulations (29 CFR Part 5): I will abide by and comply with the Contract Work Hours and Safety Standards Act as supplemented by Department of Labor regulations. I acknowledge that I shall be required to compute the wages of every mechanic and laborer on the basis of a standard work week of forty (40) hours. I acknowledge that work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of forty (40) hours in the work week. The requirements also provide that no laborer or mechanic may be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous (these requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market or to contracts for transportation or transmission of intelligence).
- K. Rights to Inventions Made Under a Contract or Agreement (37 CFR 401): I acknowledge that, if the Federal award meets the definition of “funding agreement” under 37 CFR

401.2 (a) and if the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.

Bidder’s Name and Title: _____

Bidder’s Certificate of Responsibility Number: _____

Bidder’s Signature: _____ Date: _____

STATE OF _____

COUNTY OF _____

SWORN AND SUBSCRIBED BEFORE ME, the undersigned notary public, this the _____ day of _____, 20____.

NOTARY PUBLIC

My Commission Expires: _____.

END OF FORM

SECTION 00 52 13
AGREEMENT FORM

PART 1 - GENERAL

1.01 CONTRACT

- A. The work is to be executed under a single fixed-price contract, Standard Form of Agreement Between Owner and Contractor, AIA Document A101, 2017 Edition.
- B. A copy of the Agreement is enclosed herein (it follows this page).
- C. Prospective bidders should read and understand the Agreement form before submitting bids or executing the Agreement.
- D. Refer also to the following information found in the appendices:
 - 1. Appendix “A” for special provisions stipulated by the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program. These provisions will be attached to the Owner-Contractor Agreement as an exhibit.
 - 2. Appendix “C” for the Appalachian Regional Commission’s Interim Implementation Guidance on the Application of the Buy America Preference in ARC Grants. These provisions will be attached to the Owner-Contractor Agreement as an exhibit.

END OF SECTION



AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the _____ day of _____ in the year _____
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement.

AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

- ☐ The date of this Agreement.
- ☐ A date set forth in a notice to proceed issued by the Owner.
- ☐ Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

- ☐ Not later than () calendar days from the date of commencement of the Work.

☐ By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
-----------------	-----------------------------

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
------	-------

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance
------	-------	---------------------------

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
------	-------

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than () days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

(Insert rate of interest agreed upon, if any.)

_____ %

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

- ☐ Arbitration pursuant to Section 15.4 of AIA Document A201–2017
- ☐ Litigation in a court of competent jurisdiction
- ☐ Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:

(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:

(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:

(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:

(Insert the date of the E203-2013 incorporated into this Agreement.)

- .5 Drawings

Number	Title	Date
--------	-------	------

- .6 Specifications

Section	Title	Date	Pages
---------	-------	------	-------

- .7 Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

- .8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

☐ AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

☐ The Sustainability Plan:

Title	Date	Pages
-------	------	-------

☐ Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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.9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

CONTRACTOR (Signature)

(Printed name and title)

(Printed name and title)

SECTION 00 61 00
INSURANCE AND BONDS

PART 1 - GENERAL

1.01 INSURANCE

- A. The Contractor is responsible for maintaining insurance coverage including, but not limited to:
 - 1. Liability insurance.
 - 2. Workmen's Compensation.
 - 3. Builder's Risk for the amount of the Contract.
 - 4. Owner's/Contractor's Protective Liability.
- B. Refer also to the Exhibit (AIA Document A101-2017, Exhibit A, Insurance and Bonds) which follows this page.

1.02 SECURITY FOR FAITHFUL PERFORMANCE

- A. A Performance Bond and a Payment (Labor and Material) Bond are required as a condition of this Contract.
- B. Simultaneous with delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for the faithful performance of this Contract and for the payment of all persons performing labor on the project under this Contract and furnishing materials in connection with this Contract in the amount of one hundred percent (100%) of the contract sum for payment, executed on AIA Document A312.
- C. The surety on such bond or bonds will be a duly authorized surety company who is licensed by the State of Mississippi's Commissioner of Insurance and who has a B++ or higher rating in accordance with the most recent edition of the A.M. Best Company, Inc., Key Rating Guide.
- D. All bonds shall be countersigned by a Mississippi resident agent with the name and address typed or lettered legibly.
- E. All bonds must be accompanied by an appropriate Power of Attorney.

END OF SECTION



Document A101® – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor.

for the following **PROJECT:**
(Name and location or address)

South Tippah School District
Tippah County Technical Center Building Addition
Ripley, Mississippi
PryorMorrow Project Number 2024520
Project Location: Tippah Career and Technology Center, 2560 County Road 501, Ripley, Mississippi 38663.

THE OWNER:
(Name, legal status and address)

South Tippah School District
402 Greenlee Street
Ripley, Mississippi 38663

THE CONTRACTOR:
(Name, legal status and address)

To be determined via competitive bid.

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- A.1 GENERAL**
- A.2 OWNER'S INSURANCE**
- A.3 CONTRACTOR'S INSURANCE AND BONDS**
- A.4 SPECIAL TERMS AND CONDITIONS**

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201®–2017, General Conditions of the Contract for Construction. Article 11 of A201®–2017 contains additional insurance provisions.

§ A.2.2 Liability Insurance

The Contractor will pay for and maintain such insurance as will protect the Owner and the Architect from their contingent liability to others for damages because of bodily injury, including death, which may arise from operations under this Contract and other liability for damages which the Contractor is required to insure under any provision of this Contract. Certificate of this insurance shall be filed with the Owner and the Architect and will be the same limits set forth in this Exhibit A, Article A.3.2.2.

§ A.2.3 Required Property Insurance

§ A.2.3.1 The Contractor shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Contractor's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until final payment has been made as provided in Article 9.10 of AIA Document A201-2017 or until no person or entity other than the Owner has an insurable interest in the property required by this Section A.2.3 to be covered, whichever is later. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 **Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss

Sub-Limit

Not applicable.

§ A.2.3.1.2 **Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage

Sub-Limit

Not applicable.

§ A.2.3.1.3 The Contractor shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 **Deductibles and Self-Insured Retentions.** If the property insurance requires minimum deductibles, the Contractor shall pay the deductible and all other costs not covered because of such deductibles. If the Contractor or the insurer increases the required minimum deductibles above the amounts so identified or if the Contractor elects to purchase this insurance with voluntary deductible amounts, the Contractor shall be responsible for payment of the additional costs not covered because of such increased or voluntary deductible amounts.

§ A.2.3.1.5 The insurance required by this Section A.2.3.1 shall provide coverage for physical damage to property while it is in storage and in transit to the construction site on an "all risk" completed value form.

§ A.2.3.1.6 The insurance required by this Section A.2.3.1 shall provide coverage for property owned by the Contractor and used on the Project, including scaffolding and other equipment.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

- ☐ **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance,** to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.
- ☐ **§ A.2.4.2 Ordinance or Law Insurance,** for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.
- ☐ **§ A.2.4.3 Expediting Cost Insurance,** for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.
- ☐ **§ A.2.4.4 Extra Expense Insurance,** to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.
- ☐ **§ A.2.4.5 Civil Authority Insurance,** for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.
- ☐ **§ A.2.4.6 Ingress/Egress Insurance,** for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

- [] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

- [] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information.
(Indicate applicable limits of coverage or other conditions in the fill point below.)

- [] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage

Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner and the Architect as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

The Contractor's certificate of insurance must state that the Owner and the Architect are additional insureds under the referenced Commercial General Liability (CGL) policy and that all of the Contractor's contractual liabilities, including, but not limited to, its indemnity obligations, are covered by such CGL policy. Any language to the contrary contained on the certificate of insurance form or elsewhere is deemed stricken.

The Contractor's certificate of insurance must also state that all of the Contractor's contractual liabilities, including, but not limited to, its indemnity obligations, are covered. Any terms and conditions contained in the certificate of insurance which are contrary to the Contractor's contractual obligations are hereby stricken from the certificate.

§ A.3.1.4 Furnish one (1) copy of the certificate of insurance herein required for each copy of the Agreement, specifically setting forth evidence of all coverage required. Furnish to the Owner and the Architect copies of any endorsements that are subsequently issued amending coverage or limits. If the coverages are provided on a claims-made basis, the policy date or the retroactive date shall predate the Contract and the termination date of the policy, or the applicable extended reporting period, shall be no earlier than the termination date of coverages required to be maintained after final payment.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than Five Hundred Thousand Dollars and Zero Cents (\$ 500,000.00) each occurrence, One Million Dollars and Zero Cents (\$ 1,000,000.00) general aggregate, and One Million Dollars and Zero Cents (\$ 1,000,000.00) aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than Five Hundred Thousand Dollars and Zero Cents (\$ 500,000.00) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than One Hundred Thousand Dollars and Zero Cents (\$ 100,000.00) each accident, One Hundred Thousand Dollars and Zero Cents (\$ 100,000.00) each employee, and Five Hundred Thousand Dollars and Zero Cents (\$ 500,000.00) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than (\$) per claim and (\$) in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[] § A.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to

purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

- ☐ **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than (\$) per claim and (\$) in the aggregate, for Work within fifty (50) feet of railroad property.
- ☐ **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than (\$) per claim and (\$) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.
- ☐ **§ A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.**
- ☐ **§ A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.**

☒ **§ A.3.3.2.6 Other Insurance**

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits
Owner's/Contractor's Protective Liability	\$1,000,000.00
Builders Risk	Amount of the Contract
Excess Liability	\$1,000,000.00

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type	Penal Sum (\$0.00)
Payment Bond	Amount of the Contract
Performance Bond	Amount of the Contract

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

Not applicable.

SECTION 00 72 13
GENERAL CONDITIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. The General Conditions of the Contract for Construction is AIA Document A201-2017 Edition.
 - 1. See Section 00 73 00 for supplementary conditions.
- B. If a conflict exists between the General Conditions and the specifications, the specifications shall rule. Any party discovering a conflict between the specifications and the General Conditions shall immediately notify the Architect in writing.
- C. A copy of the General Conditions is enclosed herein (it follows this page).
- D. Prospective bidders should read and understand the General Conditions before submitting bids or executing the Agreement.

END OF SECTION

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

South Tippah School District
Tippah County Technical Center Building Addition
Ripley, Mississippi
PryorMorrow Project Number 2024520
Project Location: Tippah Career and Technology Center, 2560 County Road 501, Ripley,
Mississippi 38663.

THE OWNER:

(Name, legal status and address)

South Tippah School District
402 Greenlee Street
Ripley, Mississippi 38663

THE ARCHITECT:

(Name, legal status and address)

PryorMorrow PC
Post Office Box 7066
431 West Main Street, Suite 300 (38804)
Tupelo, Mississippi 38802-7066

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ADDITIONS AND DELETIONS:

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

Init.

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User Notes:

(2019906666)

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These

obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the 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.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional,

whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work,

provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the

Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .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, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;

- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities

proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the

procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and

approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The following Supplemental Conditions modify the “General Conditions of the Contract for Construction,” AIA Document A201, 2017 Edition. Where a portion of the General Conditions is modified or deleted by the Supplemental Conditions, the unaltered portions of the General Conditions shall remain in effect. In the event of a conflict between the General Conditions of the Contract for Construction and Section 00 73 00, Section 00 73 00 shall control even if the conflicting provisions in the General Conditions of the Contract for Construction are not expressly revised or deleted by reference in Section 00 73 00.
- B. The General Conditions may also be supplemented or amplified elsewhere in the Contract Documents by provisions located in, but not necessarily limited to, Division 1 of the specifications.

1.02 SUPPLEMENTS

ARTICLE 1 – GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

Delete the last sentence in Article 1.1.1 and insert the following:

The Contract Documents shall include Instruction to Bidders, the plans, the specifications, including Divisions 0 through 48, all Addenda and modifications to the plans and/or specifications, the agreement between Owner and Contractor, the performance and payment bonds, the Notice to Proceed, and any executed Change Orders. Information and documentation pertaining to soil investigation data, laboratory investigation, soil borings and related information included herein are not part of the Contract Documents. In the event of a conflict between the provisions of Division 0 and any other section of the Contract Documents, such other section(s) shall govern.

1.1.2 THE CONTRACT

Add the following to the end of Article 1.1.2:

When there is a conflict between large scale drawings and small scale drawings, the question shall be promptly submitted to the Architect for interpretation, explanation, or clarification. One drawing does not take precedence over another. Where the word “similar” appears on the plans, it shall not be interpreted to mean “identical” and shall require the Contractor to coordinate the actual conditions and dimensions of the location where “similar” conditions are shown to occur.

1.1.9 MISCELLANEOUS DEFINITIONS

Add the following:

The term “products” as used in Supplementary Conditions includes materials, systems, and equipment.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.4 Add the following to Article 1.2.4:

It is the intent of the Contract Documents that the Contractor shall properly execute and complete the Work described by the Contract Documents, and unless otherwise provided in the Contract, the Contractor shall provide labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services, whether temporary or permanent and whether or not incorporated in the Work, in full accordance with the Contract Documents and reasonably inferable from them as necessary to produce the intended results.

1.2.5 Add the following to Article 1.2.5:

The Contract Documents shall be interpreted collectively, each part complementing the others and consistent with the intent of the Contract Documents. Unless an item shown or described in the Contract Documents is specifically identified to be furnished or installed by the Owner or others or is identified as “Not In Contract” (“NIC”), the Contractor’s obligation relative to that item shall be interpreted to include furnishing, assembling, installing, finishing, and/or connecting the item at the Contractor’s expense to produce a product or system that is complete, appropriately tested, and in operable conditions ready for use or subsequent construction or operation by the Owner or separate contractors. The omission of words or phrases for brevity of the Contract Documents, the inadvertent omission of words or phrases, or obvious typographical or written errors shall not defeat such interpretation as long as it is reasonably inferable from the Contract Documents as a whole.

Except as noted otherwise, references to standard specifications or publications of associations, bureaus, or organizations shall mean the latest edition of the referenced standard specifications or publications as of the date of the advertisement for bids.

In the case of inconsistency between drawings and specifications or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect’s interpretation.

Any doubt as to the meaning of the Contract Documents or any obscurity as to the wording of them shall be promptly submitted in writing to the Architect for written interpretation, explanation, or clarification.

1.7 DIGITAL DATA USE AND TRANSMISSION

Delete Article 1.7 in its entirety.

1.8 BUILDING INFORMATION MODELS USE AND RELIANCE

Delete Article 1.8 in its entirety.

ARTICLE 2 – OWNER

2.2 EVIDENCE OF THE OWNER’S FINANCIAL ARRANGEMENTS

2.2.1 Add the following to Article 2.2.1:

If the Project is a private project, not funded by public funds, then...

2.2.2 Delete Article 2.2.2 in its entirety

2.3 INFORMATION AND SERVICES REQUIRED BY THE OWNER

2.3.1 Delete Article 2.3.1 in its entirety

2.3.2 Add the following at the end of Article 2.3.2:

NOTE: The term “Architect” or “Design Professional” as used in the Contract Documents refers to PryorMorrow PC.

2.3.4 Delete Article 2.3.4 in its entirety

2.3.6 Delete Article 2.3.6 in its entirety and insert the following:

The Contractor will be furnished free of charge a digital copy of the plans and specifications, including all addenda. Printed sets will be furnished at the cost of reproductions, postage, and handling.

2.4 OWNER’S RIGHT TO STOP THE WORK

2.4 Delete Article 2.4 in its entirety and insert the following:

If the Contractor fails to correct work which is not in accordance with the requirements of the Contract Documents as required by Article 12.2 or fails to carry out work in accordance with the Contract Documents or fails to perform any of its obligations under the Contract Documents, the Owner may issue a written order to the Contractor to stop the work, or any portion thereof, until the cause for such order has been eliminated. However, the right of the Owner to stop the work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Article 6.1.3.

The rights and the remedies under this Article 2.4 are in addition to and do not in any respect limit any other rights of the Owner, including its termination rights under Article 14.

ARTICLE 3 – CONTRACTOR

3.1 GENERAL

3.1.1 Add the following at the end of Article 3.1.1:

The relationship of the Contractor to the Owner shall be that of independent contractor, and nothing in the Contract Documents is intended to, nor should it be construed as, creating any other relationship, expressed or implied, between the Owner and the Contractor.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.5 Add the following Article 3.2.5:

The Owner is entitled to deduct from the Contractor's pay applications for amounts paid to the Architect for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior project correspondence or documentation.

3.4 LABOR AND MATERIALS

3.4.2 Add the following to the end of Article 3.4.2:

Some sections of the specifications may not allow substitutions of materials, products, or equipment. Where substitution is allowed, substitutions of products in place of those specified shall be only under the conditions set forth in Section 01 25 13 of the specifications.

By making request for substitutions, the Contractor:

- .1 Represents that the Contractor has personally investigated the proposed substitute product and determined that it is in all respects equal to or superior to the specified product;
- .2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for the specified product;
- .3 Certifies that the cost data presented is complete and includes all related costs under this Contract, except the Architect's redesign cost, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
- .4 Shall coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects at its costs.

All substitutions shall be submitted within thirty (30) days of the Notice to Proceed, as per Section 01 25 13.

3.4.4 Add the following Article 3.4.4:

The Contractor represents that it has independently investigated, considered, and understands the labor conditions in the area surrounding the project and acknowledges

that such conditions may impact the Contractor's cost and/or time of performance of the Contract. Therefore, the Contractor further represents that the contract price is based upon the Contractor's independent investigations into such labor conditions and that the Contract Time is reasonable and the date of substantial completion is obtainable. As a result, the Contractor assumes the risk of increased costs, if any, incurred by it arising out of or related to such labor conditions and acknowledges that the Contractor and its surety will reimburse the Owner for any additional costs the Owner incurs arising out of or related to such labor conditions.

3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

3.7.1 Delete Article 3.7.1 in its entirety and insert the following:

The Contractor shall secure and pay for the building permit and all other permits, fees, licenses, inspections, and all other approvals and charges necessary for proper execution and completion of the work.

3.7.3 Delete the words "knowing it to be" from Article 3.7.3.

3.9 SUPERINTENDENT

3.9.1 Add the following to the end of Article 3.9.1

The Contractor shall also employ a competent project manager who shall be primarily responsible for the Contractor's home office activities in connection with the Contract.

The Owner shall have the right, which shall be exercised in a reasonable fashion, to approve the project manager and/or superintendent employed by the Contractor, either before or during the progress of construction.

The superintendent and project manager for the project shall be designated by the Contractor at the pre-construction conference. After the Owner's approval of such project manager and superintendent, they shall not be replaced by the Contractor without the Owner's prior written consent, which consent is required unless the Contractor submits proof satisfactory to the Owner that the superintendent and/or project manager should be terminated by the Contractor for cause.

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

3.10.1 Add "but, in any event, no less than submission of a revised schedule with each monthly application for payment pursuant to Section 9.3" between "intervals" and "as" in the fourth sentence.

3.10.3 Delete Article 3.10.3 in its entirety and insert the following:

Time being of the essence, the Contractor shall perform the work in accordance with the most recent schedule submitted to and approved by the Owner and the Architect.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.6 Add the following to the end of Article 3.12.6:

In reviewing shop drawings, product data, samples, and similar submittals, the Architect shall be entitled to rely upon the Contractor's representation that such information is correct and accurate.

3.12.8 Add the following to the end of Article 3.12.8:

Unless such written notice has been given, the Architect's approval of a shop drawing, product data, sample, or similar submittal shall not constitute approval of any changes not requested on the prior submittal.

3.12.9 Add the following to the end of Article 3.12.9:

The Architect's review of the Contractor's submittals will be limited to examination of an initial submittal and one (1) resubmittal. The Architect's review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for evaluation of such additional submittals.

3.12.10.1 Delete the second sentence entirely and replace with the following:

The performance and design criteria specified by the Architect in the Contract Documents shall be prepared in accordance with the applicable standard of care.

3.18 INDEMNIFICATION

3.18.1 Add the word "defend" before the word "indemnify" in the first line, add the words "or nonperformance" after the word "performance" in the third line, and delete the phrase which begins "provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself)," to the end of the sentence.

ARTICLE 4 – ARCHITECT

4.2 ADMINISTRATION OF THE CONTRACT

4.2.10 Delete Article 4.2.10 in its entirety

ARTICLE 5 – SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 Delete the phrase "Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract" from the first sentence of Article 5.2.1 and insert the following in lieu thereof:

"The Contractor, with its first Application for Payment and as a condition to the Owner's obligation to make payments to the Contractor under Article 9 of the General Conditions as supplemented herein,"

5.2.5 Add the following:

The Contractor's unauthorized substitutions of any subcontractor, supplier, person, or entity previously identified by the Contractor in accordance with Article 5.2.1 shall entitle the Owner to reject the work, materials, or products furnished and require removal and replacement at no additional cost to the Owner.

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 Delete Articles 6.1.1 in its entirety and insert the following:

The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the project with the Owner's own forces and to award separate contracts either in connection with other portions of the project or other construction or operation on the site. In such event, the Contractor shall coordinate its activities with those of the Owner and of separate contractors so as to facilitate the general progress of all work being performed by all parties. Cooperation will be required in the arrangement for the storage of materials and in detailed execution of the work.

The Contractor, including his subcontractors, shall keep informed of the progress and the detailed work of the Owner or separate contractors and shall immediately notify the Architect of lack of progress or delays by separate contractors which are affecting the Contractor's work. Failure of the Contractor to keep informed of the progress of the work of the Owner or other contractors and/or failure of the Contractor to give notice of lack of progress or delays by the Owner or separate contractors shall be deemed to be acceptance by the Contractor of the status of progress by other contractors for the proper coordination and completion of the Contractor's work. If, through acts of neglect on the part of the Contractor, the Owner or any separate contractors or subcontractors shall suffer loss or damage or assert any claims of whatever nature against the Owner, the Contractor shall defend, indemnify, and hold harmless the Owner from any such claims or alleged damages, and the Contractor shall resolve such alleged damages or claims directly with the separate contractors or subcontractors.

6.1.2 Delete Articles 6.1.2 in its entirety

6.1.3 Delete Articles 6.1.3 in its entirety

6.1.4 Delete Articles 6.1.4 in its entirety

6.2 MUTUAL RESPONSIBILITY

6.2.3 Delete Article 6.2.3 in its entirety

ARTICLE 7 – CHANGES IN THE WORK

7.1 GENERAL

7.1.1 Add "written" in front of "Change Order" on the second line.

7.1.2 Add in the last line between “Work” and “may” the words “not affecting time or money”.

7.1.3 Add the following to the end of article 7.1.3:

Except as permitted in Article 7.3, a change in the Contract Time shall only be accomplished by written Change Order. Therefore, the Contractor acknowledges that it is not entitled to a change in the Contract Sum or the Contract Time in the absence of a written Change Order on the basis of the course of conduct or dealings between the parties and/or the Owner’s express or implied acceptance of alterations or additions to the work and/or the Owner’s unjust enrichment by the Contractor’s work or any other basis otherwise allowed by law or the facts and the Contractor agrees that any such extra or changed work was performed by it as a volunteer.

7.2 CHANGE ORDERS

7.2.2 Add the following to Article 7.2.2:

The Contractor’s execution of a Change Order constitutes a final settlement to the Contract Sum and construction schedule and the Contract Time for all matters relating to or arising out of the change in the work that is the subject of the Change Order including, but not limited to, all direct and indirect costs associated with such change, all extended direct job site and home office overhead expenses, and any and all delay and impact costs for the change, whether alone or in combination with other changes, including any impact, ripple, or cumulative effect resulting therefrom, if any.

7.2.3 Add the following to Article 7.2.3:

Adjustments to the Contract Sum by Change Order shall be based upon one of the methods set forth in Article 7.3.3.1, 7.3.3.2, 7.3.3.3, or 7.3.3.4, as appropriate. A reasonable allowance for the combined overhead and profit included in the Change Order shall be based upon the schedule set forth in Article 7.3.11, as supplemented.

7.2.4 Add the following to Article 7.2.4:

In order to facilitate consideration of Change Order requests, all such requests, except those involving an amount less than \$500.00, must be accompanied by a complete itemization of costs, including labor, materials, and subcontractor costs which shall likewise be itemized. Changes for more than \$500.00 will not be approved without such itemization.

7.3 CONSTRUCTION CHANGE DIRECTIVE

7.3.5 Add “Owner or” between “the” and “Contractor” in both places they appear in this Article 7.3.5.

7.3.8 Delete the first sentence and insert the following:

The amount of credit to be given by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be the actual net cost plus reasonable allowances for the combined overhead and profit based upon the schedule set forth in Article 7.3.11.

7.3.11 Add the following to Article 7.3.11:

The allowance for overhead and profit combined, including all taxes, permits, insurance, bond, job superintendent, job and home office expenses, extended direct job and home office overhead, and any and all delay, impact, inefficiency, disruption, and ripple effect to be included in the total cost to the Owner is limited to fifteen percent (15%) for adds and five percent (5%) for deducts of the total of the actual cost of materials, labor, and subcontracts. All subcontractors shall acquiesce to the same requirements when participating in a Change Order.

Costs to which overhead and profit is to be applied shall be determined in accordance with Article 7.3.4.

ARTICLE 8 – TIME

8.2 PROGRESS AND COMPLETION

8.2.1 Add the following to the end of the second sentence of Article 8.2.1:

...and that the Contractor is fully capable of properly completing the work within the Contract Time.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 Add the following to the end of Article 8.3.1:

However, to the fullest extent permitted by law, and notwithstanding any other provisions in the Contract Documents, the Owner and its agents and employees and the Architect shall not be liable for any damages for delay for direct or indirect costs, extended home office overhead, idle or inefficient labor or equipment, cost escalations, or monetary claims of any nature arising from or attributable to delay by any cause whatsoever, the Contractor's sole and exclusive remedy for delay by any cause whatsoever is an extension of the Contract Time but no increase in the Contract Sum. Adverse weather shall not be grounds for time extensions unless the number of days exceeds the days provided in Section 01 29 10 and directly affects the overall completion of the work as reflected in the critical path of the Contractor's updated and accepted construction schedule.

8.3.3 Add the following to the end of Article 8.3.3:

No delay, interference, hindrance, or disruption, from whatever source or cause, in the progress of the Contractor's work shall be a basis for an extension of time and/or additional compensation unless the delay, interference, hindrance, or disruption (1) is without the fault and not the responsibility of the Contractor, its subcontractors, and/or suppliers and (2) directly affects the overall completion of the work as reflected on the critical path of the Contractor's updated and accepted construction schedule. The Contractor expressly agrees that the Owner shall have the benefit of any float in the construction schedule and that delays to construction activities, which do not affect the overall completion of the work, do not entitle the Contractor to any extension in the Contract Time and/or increase in the Contract Sum.

8.3.4 Add the following Article 8.3.4:

All claims by the Contractor for an increase in the Contract Time must follow the procedures set forth in Article 15.1.2, 15.1.3, 15.1.5, and 15.1.6, including the requirement that the Contractor give written notice of any claim within twenty-one (21) days after occurrence of the event giving rise to such claim or within twenty-one (21) days after the Contractor first recognizes the conditions giving rise to the claim, whichever is earlier.

8.3.5 Add the following Article 8.3.5:

If the Contractor submits a schedule indicating or otherwise expressing an intent to complete the work prior to the date of substantial completion, the Owner shall have no liability to the Contractor for any failure by the Contractor to complete the work prior to the expiration of the Contract Time.

ARTICLE 9 – PAYMENTS AND COMPLETION

9.3 APPLICATIONS FOR PAYMENTS

9.3.1 Add the following to the end of Article 9.3.1:

The form of Application for Payment will be the current edition of the AIA Document G702, Application for Certification for Payment, supported with AIA Document G703, Continuation Sheet.

9.3.1.3 Add the following to Article 9.3.1.3:

In any contract awarded by The State of Mississippi or any agency, unit, or department of The State of Mississippi, or by any political subdivision thereof, the amount of retainage that may be withheld is governed by Mississippi law.

In all other contracts, the Owner will retain, until the work is one hundred percent (100%) complete, five percent (5%) of the amount due the Contractor on account of progress payments. No reduction in retainage will be made until final payment is made except that when the original Contract Amount is in an amount equal to or greater than \$750,000.00, then whenever such Work is fifty percent (50%) complete and on schedule and satisfactory, in the opinion of the Architect and the Owner, fifty percent (50%) of the retainage may be returned to the Contractor and two and one half percent (2.5%) will be retained on all subsequent progress payments. The Owner may subsequently increase the retainage if the Contractor's manner of completion of the work and/or its progress do not remain satisfactory to the Architect and/or the Owner or if the Surety withholds its consent to payment for other good and sufficient reasons.

When submitting request for reduction in retainage, the Contractor shall include, with the application, a Consent of Surety to Reduction of Retainage and a Power of Attorney.

9.3.2 Add the following to the end of the first sentence in Article 9.3.2:

...upon submission by the Contractor of an Application for Payment for such materials and/or equipment, supported by invoice(s) for such materials and/or documentation required by Section 00 73 00, Article 9.3.2.2, subpart .4.

9.3.2.1 Add the following to Article 9.3.2.1:

Payment for materials stored at some location other than the project site may be approved by the Architect and the Owner after the Contractor has submitted the following items:

- .1 An acceptable Lease Agreement between the Contractor or one of its subcontractors or suppliers and the owner of the land or building where the material is stored.
- .2 Consent of Surety or other acceptable bond to cover the materials stored off-site.
- .3 All Perils Insurance coverage for the full value of the materials stored off-site.
- .4 A Bill of Sale from the manufacturer to the Contractor for the stored materials.
- .5 A complete list/inventory of materials manufactured, stored, and delivered to the storage site and of materials removed from the storage site and delivered to the project.
- .6 A review by the Architect of the materials stored off-site prior to release of payment. The Contractor shall pay the Architect at the standard hourly rates of the Architect plus mileage as allowed by the IRS for the Architect to visit and verify off-site stored materials. This time and mileage begins and ends at the Architect's office.
- .7 Proof of payment of stored materials verified by the supplier must be submitted to the Architect within thirty (30) days of the Application for Payment on which payment for said materials was made. If proof of payment is not submitted within thirty (30) days, then payment for said materials will be deducted from the next Application for Payment and withheld until proof of payment is received.

9.3.2.2 Add the following to Article 9.3.2:

If approved for payment by the Architect, then payment for stored materials will be made for the invoice amount; overhead and profit will be limited to a total of ten percent (10%) of the invoice amount. Any remaining balance for this item on the Schedule of Values will be paid to the Contractor upon incorporation of the materials into the project. Payment for stored materials shall not exceed the amount indicated in the Schedule of Values less retainage.

9.3.3 Add the following to the first sentence, between "Application for Payment" and "will" in Article 9.3.3:

“, whether incorporated in the project or not,”

9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1.7 Delete the word “repeated”.

9.5.1.8 Add the following to Article 9.5.1.8:

The letter from the Contractor which is required by Article 15.1.5.2 has not been received.

9.6 PROGRESS PAYMENTS

9.6.1 Delete Article 9.6.1 in its entirety and insert the following:

Subject to the conditions of the Contract, the Owner shall make payment to the Contractor in the amount certified within thirty (30) days after receipt of the certified Application for Payment from the Architect. Payment shall not be considered late until thirty (30) days after the Owner’s receipt of the certified Application for Payment from the Architect.

9.6.1.1 The Contractor’s Applications for Payment shall be submitted on or before the twenty-fifth (25th) day of each month. Any application not submitted on or before this date may not be processed or certified until the following month.

9.6.7 Delete the word “Unless” from the first sentence in Article 9.6.7 and insert the phrase “Whether or not”.

Add the following to the end of Article 9.6.7:

The amount retained by the Contractor from each payment to each subcontractor and material supplier shall not exceed the percentage retained by the Owner from the Contractor for the subcontractor’s work.

9.7 FAILURE OF PAYMENT

9.7 Delete the words “or awarded by binding dispute resolution” in the first sentence in Article 9.7.

9.8 SUBSTANTIAL COMPLETION

9.8.1 Delete Article 9.8.1 in its entirety and insert the following:

Substantial completion for the purposes of this Contract occurs only upon the Contractor’s compliance with the following conditions precedent:

- (a) the Contractor furnishes the Contractor’s completed punch list,
- (b) the Contractor furnishes all life safety systems subcontractors’ inspection reports,
- (c) the Contractor furnishes all other required documentation by other specification sections,
- (d) the Architect certifies that the work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the work for its intended purpose,

- (e) the Owner, the Architect, the Fire Marshal, and/or the Building Inspector witness a life safety systems test,
- (f) the Fire Marshal and/or the Building Inspector provides the Contractor with a Certificate of Occupancy, and
- (g) the Contractor furnishes the Guarantee of Work set forth herein below.

The Guarantee of Work shall be submitted as a separate document signed by the Contractor and the Contractor's Surety and shall state the following:

The Contractor and the Contractor's Surety hereby guarantees that all work performed on the project is free from defective and/or nonconforming materials and workmanship and that for a period of one (1) year from the date of substantial completion or such longer period of time as may be called for in the Contract Documents for such portions of the work, the Contractor or its Surety will repair and/or replace any defective and/or nonconforming materials and workmanship in accordance with the requirements of the Contract Documents.

9.8.2.1 Add the following to Article 9.8.2.1:

The Contractor shall be responsible for the costs of inspections made by the Architect including any and all other related expenses incurred by the Architect for providing services for the project required by failure of the Contractor to achieve final acceptance/completion of the project within thirty (30) days after the first occurrence of the below described events:

1. Specified date of substantial completion; or
2. Actual date of substantial completion.

The costs of the Architect's additional services shall be deducted by the Owner from the Contractor's final Application for Payment to pay the Architect for additional services required by the Contractor's failure to achieve final completion of the project within the thirty-day period described above.

9.8.4 Delete the last sentence of Article 9.8.4 and insert the following:

Warranties required by the Contract Documents shall commence on the date of substantial completion unless otherwise provided in the Contract Documents.

9.8.5 Add the following to the end of Article 9.8.5:

The Contractor's execution of the Certificate of Substantial Completion constitutes the Contractor's representation that the items on the list accompanying the Certificate can and will be completed by the Contractor and his subcontractors within thirty (30) days of the Contractor's execution of the Certificate. Based upon this representation by the Contractor and upon the acknowledgment of the Architect that the listed items remaining can be completed within thirty (30) days, the Owner agrees to execute the Certificate of Substantial Completion. If the Contractor fails to complete the items on the list within thirty (30) days of the Contractor's execution of the Certificate, then the Owner, as its

option and without prejudice to any other rights or remedies it may have under this Contract or otherwise and without notice to the Contractor or its Surety, may proceed to have the same completed and to deduct the reasonable costs thereof from the amounts then due or thereafter to become due to the Contractor.

9.8.6 Add the following Article 9.8.6

The costs for inspections requested by the Contractor and made by the Architect which are not required by Articles 4, 9.8, 9.10, or 12 of the General Conditions and any other inspection required by Article 12 other than the year-end inspection itself will be the responsibility of the Contractor and will be deducted by the Owner from the Application for Payment submitted after the Owner's receipt of the Architect's statement for its costs of additional inspections. These costs are not the result of the Contractor's failure to timely complete the Contract within the specified time and, therefore, such costs are in addition to, and not part of, any liquidated damages calculations, if any.

9.8.7 Add the following Article 9.8.7

Upon the Owner's acceptance of the work as substantially complete and upon the Contractor's compliance with all conditions precedent to substantial completion as stated in Section 00 73 00, Article 9.8.1, and upon application by the Contractor, the Owner will pay to the Contractor all retainage held by the Owner less an amount equal to the greater of (a) two percent (2%) of the Contract Sum, or (b) two hundred percent (200%) of the estimated cost of the work remaining to be performed by the Contractor in accordance with the Architect's determination. Final payment, including all retainage, shall be made at the time and in the manner provided for final payment in accordance with the provisions of Article 9.10 and the additional conditions precedent to final acceptance/payment set forth in Section 00 73 00, Article 9.8.5.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1.2 Add the following to Article 9.9.1.2:

The Owner's occupancy or use of any completed or partially completed portions of the work shall not affect the Contractor's obligation to complete incomplete items on the list attached to the Certificate of Substantial Completion within the time fixed in the Certificate and does not waive the Owner's rights to obtain completion of incomplete items at the Contractor's expense upon the Contractor's failure to timely complete the same.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.2 Insert between "warranties, and (6)" in Article 9.10.2:

- (6) all closeout documents required by the Contract Documents in a form satisfactory to the Architect and the Owner, and
- (7) the manufacturers' certificates and/or warranties required by the Contract Documents.

Delete "(6)" before "if required by Owner" and replace with "(8)".

9.11 LIQUIDATED DAMAGES

9.11.1 Add the following to Article 9.11.1:

Liquidated Damages. Time being of the essence of this Contract and a matter of material consideration thereof, a reasonable estimate in advance is established to cover losses incurred by the Owner if the project is not substantially complete on the date set forth in the Contract Documents. The Contractor and his Surety will be liable for and will pay the Owner the sums hereinafter stipulated as fixed and agreed as liquidated damages for each calendar day for delay until the work is substantially complete. The Contractor and his Surety acknowledge that the Owner's losses caused by the Contractor's delay are not readily ascertainable and that the amount estimated per day for liquidated damages is reasonable and is not a penalty.

See Section 00 41 13 – Bid Form for the established amount for liquidated damages.

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1 Add the following to the end of Article 10.1:

The Architect shall not administer the Contractor's performance of its duties and responsibilities under Article 10 because the initiation, maintenance, and supervision of safety precautions and programs is the sole responsibility of the Contractor as means, methods, techniques, sequences, and procedures of construction and, therefore, is not part of the Contractor's scope of work which is to be administered by the Architect.

ARTICLE 11 – INSURANCE AND BONDS

11.4 LOSS OF USE, BUSINESS INTERRUPTIONS, AND DELAY IN COMPLETE INSURANCE

11.4 Delete Article 11.4 in its entirety

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

12.1.2 Delete the second sentence of Article 12.1.2 entirely and replace with:

"If such work is in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense.

12.2 CORRECTION OF WORK

12.2.2 AFTER SUBSTANTIAL COMPLETION

12.2.2.1 Add the following to the end of Article 12.2.2.1:

Prior to the end of the one-year period, the Architect may schedule a warranty inspection which shall be attended by the Architect, the Owner, the Contractor, and all major

subcontractors. During the inspection, the parties shall identify all defective and/or nonconforming items and fix the time within which all defective and/or nonconforming items shall be repaired and/or replaced.

12.2.2.1.1 Add the following Article 12.2.2.1.1:

Within the one-year period provided for in the Guarantee of Work required by Article 9.8.1, if repairs or replacement are requested by the Owner in connection with the work which, in the opinion of the Owner, are rendered necessary as a result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the Contract Documents, the Contractor and/or its Surety shall promptly, upon receipt of notice from and without expense to the Owner, place in satisfactory condition in every particular all such work, correct all defects therein, and make good all damages to the building, site, equipment, or contents thereof and shall make good any work or materials or the equipment and contents of said buildings or site disturbed in fulfilling any such guarantee. If, after notice or within the time agreed upon by all parties at the warranty inspection, the Contractor and/or its Surety fail to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected in accordance with Article 2.4 and the Contractor and its Surety shall be liable for all expenses incurred. All special guarantees applicable to definite parts of the work stipulated in the Contract Documents shall be subject to the terms of this paragraph during the first year of the life of such special guarantee.

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.5 INTEREST

13.5 Delete Article 13.5 in its entirety and insert the following:

Payments due and unpaid under the Contract Documents shall bear interest as provided by applicable Mississippi law.

13.6 ATTORNEYS' FEES AND EXPENSES

13.6 Add the following Article 13.6 to private projects not funded in whole or in part by public monies:

The prevailing party in any dispute between the parties arising out of or related to this Agreement or the breach thereof shall be entitled to reasonable attorneys' and expert witness(es) fees and expenses incurred in pursuing or defending any claim.

ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1.4 Delete Article 14.1.1.4 in its entirety

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1.1 Delete the word "repeatedly" from Article 14.2.1.1.

14.2.1.3 Delete the word “repeatedly” from Article 14.2.1.3.

14.2.1.5 Add the following Articles 14.2.1.5:

Fails to achieve substantial completion of the project as described in Section 00 73 00, Article 9.8.5, within the time stated therein;

14.2.1.6 Add the following Article 14.2.1.6:

Fails to meet any deadline required by the Contract. The Contractor acknowledges that time is of the essence of this Contract and that all deadlines required by the Contract are critical to timely completion of the Contract. Therefore, the Contractor agrees that its failure to meet any deadline constitutes a substantial and material breach of this Contract, entitling the Owner to terminate the Contract.

14.2.2 Delete the word “certification” in the first sentence and insert the word “advice”.

14.2.4 Delete the phrase “Initial Decision Maker” and insert the word “Architect” in article 14.2.4.

14.2.5 Add the following Article 14.2.5:

If the Owner terminates the Contract for cause and it is determined for any reason that the Contractor was not actually in default under the Contract at the time of termination, the Contractor shall be entitled to recover from the Owner the same amount as the Contractor would be entitled to receive under a termination for convenience as provided by Article 14.4. The foregoing shall constitute the Contractor’s sole and exclusive remedy for termination of the Contract. In no event shall the Contractor be entitled to special, consequential, or exemplary damages, nor shall the Contractor be entitled to anticipated profits resulting from termination of this Contract.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.3 Add after the end of the last sentence “The Contractor shall not be entitled to receive any payment for either overhead or profit on work not performed.”

ARTICLE 15 – CLAIMS AND DISPUTES

15.1.2 Delete the phrase “in accordance with the requirements of the final dispute resolution method selected within the Agreement” from Article 15.1.2.

15.1.6 CLAIMS FOR ADDITIONAL TIME

15.1.6.2 Add the following to the end of Article 15.1.6.2:

Adverse weather shall not be grounds for extensions unless the number of rain days exceed the days provided in Section 01 29 10 of the project specifications and directly affects the overall completion of the work as reflected in the critical path of the Contractor’s updated and accepted construction schedules.

The Contractor must submit each month with his Application for Payment a separate letter stating that he is requesting an extension of time for abnormal adverse weather or that he has no claim for an extension for that period of time. Payment is not due on the Application for Payment until the letter is received. Complete justification, including weather reports, daily reports, correspondence, and any other supporting data must be provided for each day for which a request for time extension is made. A letter or statement that the Contractor was delayed is not adequate justification. The receipt of this request and data by the Architect will not be considered as the Owner's or the Architect's approval of a time extension in any way.

15.1.6.3 Add the following Article 15.1.3.3:

Claims for increase in the Contract Time shall set forth in detail the facts and circumstances which support such claim, including, but not limited to, the cause of such delay, the date such delay began to affect the critical path, the date such delay ceased to affect the critical path, and the number of days of additional time requested. The Contractor shall not be entitled to an increase in the Contract Time for delays which did not affect the critical path or to the extent there were concurrent non-excusable delays. The Contractor may be requested to provide additional documentation to substantiate its claim, including, but not limited to, schedules that indicate all activities affected by such delay.

15.1.7 Delete the first sentence in article 15.1.7 and replace with the following:

The Contractor and the Owner waive claims against each other, the Architect, and Consultants for consequential damages arising out of or relating to this Contract.

15.2 INTITIAL DECISION

15.2.4 Add "within thirty (30) days" to the end of article 15.2.4

15.3 MEDIATION – Omit this item in its entirety.

15.4 ARBITRATION – Omit this item in its entirety.

15.4.4 CONSOLIDATION -- Omit this item in its entirety.

END OF SECTION

SECTION 00 91 13

ADDENDA

PART 1 - GENERAL

1.01 SUMMARY

- A. Addenda: Any addenda to the drawings or specifications issued before or during the time of bidding shall be included in the proposal and shall become a part of the Contract.
- B. Indicate receipt of addenda on the bid form.

END OF SECTION

SECTION 00 94 00
RECORD MODIFICATIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Changes to the Contract will be handled through Change Order, AIA Document G701.

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.01 CONTRACT DOCUMENTS

- A. The Contract Documents for providing the work of the project include the following:
 - 1. Architect's drawings dated August 13, 2026.
 - 2. Project Manual (including specifications) dated August 13, 2026.

1.02 WORK TO BE EXECUTED UNDER THIS CONTRACT

- A. The project is the construction of a career-technology metal building and associated site improvements at the Tippah Career and Technology Center, 2560 County Road 501, Ripley, Mississippi 38663.
- B. The work shall include all labor, materials, equipment, services, and related activities and procedures necessary to the complete construction including the buildings, site work, mechanical, plumbing, electrical, and other improvements as shown on the drawings and required in the specifications (Project Manual).
- C. The Contractor shall provide and install lockset cores and keys. Refer to Section 01 21 00 for the hardware allowance and Section 08 71 00 for door hardware requirements.

1.03 WORK TO BE EXECUTED BY THE OWNER UNDER SEPARATE CONTRACT

- A. The Owner reserves the right to award contracts for additional work by others during the course of this project. The Contractor and all its subcontractors shall cooperate fully with all such parties in scheduling and performing any additional work as may be required by the Owner.
- B. Landscaping by the Owner. Landscape grading, topsoil, and seeding by the General Contractor.
- C. Interior loose furnishings shall be provided and installed under a separate contract.

END OF SECTION

SECTION 01 14 00
WORK RESTRICTIONS

PART 1 - GENERAL

1.01 CONTRACTOR'S USE OF PREMISES

- A. The Contractor shall limit his use of the premises for work as described in the drawings and specifications.
- B. The Contractor shall assume full responsibility for the protection and safekeeping of products under this Contract stored on the site.
- C. The campus will remain occupied during much of the construction period. Coordinate the work of this project to minimize disruptions to the Owner.
- D. State law prohibits the use of tobacco products on any public school property. The use of tobacco products on site will not be permitted throughout the duration of the project.
- E. State law prohibits the possession or use of alcohol, illegal drugs, or weapons on public school property; such possession or use is considered improper conduct and shall result in the removal of the worker and the possibility of filing charges against the worker.

END OF SECTION

SECTION 01 18 00
PROJECT UTILITY SOURCES

PART 1 - GENERAL

1.01 SCOPE

- A. Provide and install temporary and permanent utilities for the project.
- B. Coordinate specific requirements with utility providers.

1.02 FEES

- A. The Contractor is responsible for all costs associated with providing temporary and permanent utility services including costs charged by the utility providers for their involvement.
- B. All tap and meter fees shall be paid by the Contractor.
- C. Other fees will be required for utility service to the project. The Contractor shall pay all fees and costs. Contact each utility prior to bid.

1.03 TEMPORARY UTILITIES

- A. The Contractor shall make all arrangements and pay all costs for temporary utilities including temporary sanitary facilities, telephone, electricity, gas, and water.

1.04 PERMANENT UTILITIES

- A. The Contractor shall make all arrangements and pay all costs for permanent utilities including sanitary sewer, electricity, water, gas, telephone, communications, and TV cable service.

1.05 UTILITY CONTACTS

- A. Bidders shall contact the following for coordination and to ascertain costs of electrical, water, gas, and sewer services prior to bid:

- 1. Electrical: Tippah Electric Power Association
Post Office Box 206
109 Cooper Street (38663)
Ripley, Mississippi 38663-0206
Telephone: (662) 837-8139

- 2. Water, Sewer, and Gas: Department of Public Works
City of Ripley
500 South Main Street
Ripley, Mississippi 38663
Telephone: (662) 837-7154

END OF SECTION

SECTION 01 21 00
ALLOWANCES

PART 1 - GENERAL

1.01 CASH ALLOWANCES: LATENT CONDITIONS

A. Amount:

1. Include a \$45,640.00 allowance for latent conditions in the Base Bid.

B. Products:

1. Defects exposed to view under normal pre-bid observation conditions are not eligible for replacement under this allowance.
2. Products that are specifically designated to be removed or replaced elsewhere in the specifications or that are indicated on the drawings are not eligible under this allowance.
3. Replacement products shall be in conformance with the respective technical specifications for the type of material replaced. If there is no specification for the product, it shall match the existing original product. If the original product cannot be obtained, the Contractor shall submit an appropriate substitute product for the Architect's review and approval.

C. Procedure:

1. The Contractor shall present a list of proposed unit prices for concealed materials that may be defective and subject to removal. The Architect shall approve prices which are fair and reasonable. Proposed prices shall include itemized material and labor/installation costs. All overhead, profit, sales or other taxes, bonds, and insurance shall be included in the Contractor's original bid and shall not be deducted from the latent conditions allowance.
2. The Contractor shall notify the Architect at least twenty-four (24) hours prior to schedule the uncovering of work so that the Architect may be present.
3. The Contractor shall notify the Architect whenever he uncovers existing work that would prohibit proper construction if left in place as any part of the substrate.
4. The Architect shall review the work and verify the conditions claimed. He is authorized to prepare a signed, written Construction Change Directive itemizing the specific type, location, and quantity of material that should be replaced, as well as a fair and reasonable price.
5. The Contractor shall perform the work described in the Construction Change Directive in accordance with the respective technical specification for the material involved and all conditions of this Contract.

6. The Architect is not authorized to expend funds by Construction Change Directive in excess of the amount specified under the allowance. Any work required in excess of this amount must be done by a separate written Change Order which must be approved prior to execution of the work.
7. The Contractor may elect to proceed with replacement of minor defective incidental work without notifying the Architect or going through the Construction Change Directive approval process if there will be no costs charged to the allowance or the Owner.
8. Any materials replaced or works performed prior to obtaining the Architect's Construction Change Directive are not chargeable under this allowance.

1.02 CASH ALLOWANCES: PRODUCTS

A. Costs included in allowances:

1. Actual cost of product or item to the Contractor substantiated by invoice (not manufacturer-suggested retail), less any applicable trade discounts.
2. Invoices for materials covered under allowances shall be delivered directly to the Architect as provided from material suppliers. Adjustments to the contract sum will be made according to the actual invoices delivered to the Architect.

B. Contractor's costs included in the contract sum (original bid):

1. Contractor's costs for transportation to the site, unloading, and handling on the site
2. Protection of materials from elements and damage.
3. All labor, installation costs, sales or other taxes, overhead, profit, bonds, insurance, incidentals, and other expenses as required for the complete installation shall be included in the Contractor's original bid and shall not be deducted from the product allowance.

C. Schedule of allowances to be included in the Base Bid:

1. The bidder is reminded to refer to 1.01 A of this section for the amount of the allowance for latent conditions.
2. \$750.00 per thousand for purchase and delivery of face brick.
3. \$250.00 per cylinder per lockable door in the building to purchase Best cylinders and cores keyed to the Owner's specifications and to have the permanent cores installed by Best representatives. For this project, assume twenty-one (21) cylinders or a total allowance of \$5,250.00. This amount will be adjusted up or down after the final numbers are determined via the change order process. Note: The labor to install cylinders in locksets and panic devices shall be included in the Base Bid.

4. \$42,000.00 for purchase and delivery of door hardware.
5. \$20,000.00 for materials testing and special inspection by the Owner-selected testing agent.

1.03 RECORDS

- A. The Contractor shall maintain a record of all expenditures authorized and approved by the Architect's Construction Change Directives under each allowance and shall submit a written report of expenditures and allowance balance at the request of the Architect and/or the Owner.
- B. The Contractor shall include all allowances on the schedule of values per the amount scheduled.
- C. Amounts due on allowances shall not be paid until the specific product/item is installed or stored on site per the requirements of this Contract.
- D. At project closeout, should the actual costs incurred be more or less than the specified amount of any allowance, the contract sum will be adjusted by a Change Order equal to the amount of the difference.

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 - GENERAL

1.01 PROCEDURES

- A. Purpose: To enable the Owner to consider alternative levels of construction and to compare costs with the possibility of adjusting the level of quality and/or of adding to or subtracting from the scope of work of the project in such a manner that the Owner receives the project most beneficial to the Owner for the available funds.
- B. Acceptance or rejection of any alternate is at the sole discretion of the Owner.
 - 1. The Owner has not established a priority for the alternates. The Owner reserves the right to award or reject alternates in any order and in any combination so that the Owner receives the best possible project within the available funds.
- C. Accepted alternates shall become a part of the Owner-Contractor Agreement.

1.02 SCHEDULE OF ALTERNATES

- A. Alternate Number 1 (additive): Asphalt paving of new parking area and drive in lieu of limestone paving.
- B. Alternate Number 2 (additive): Furnish and install the electric generator for the career tech addition.

END OF SECTION

SECTION 01 25 13

PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SUBSTITUTION PROCEDURES

- A. Products of other manufacturers equal to those specified herein will be considered for substitution. Refer to the General Conditions for additional requirements.
- B. Substitutions will not be considered during the bid phase or any other time prior to the award of the Contract.
- C. Not later than thirty (30) days from the contract date, the Contractor shall provide a list showing the name of the manufacturer proposed to be used for each of the products identified in the Project Manual and, where applicable, the name of the installing subcontractor.
- D. The Architect will promptly reply in writing to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposal.
- E. Within thirty (30) days after the Contract has been executed, the Owner and the Architect will consider a formal request for the substitutions of products in place of those specified. The General Contractor is responsible for providing product data and product references to substantiate that substitutions are equal to products specified. By making requests for substitutions, the Contractor represents the following:
 - 1. That he or she has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to the specified product.
 - 2. That he or she will provide the same warranty for the substitutions as that required for the specified product.
 - 3. That the cost data is complete and includes all related costs under this Contract and that any claims for additional costs and/or time in connection with the substitution are hereby waived.
 - 4. That he or she will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 APPLICATION FOR PAYMENT

- A. Submit Application for Payment to the Architect:
 - 1. Submit applications on AIA Document G702.
 - 2. Submit four (4) original applications for payment each month.
 - 3. Break down project costs by division and section in CSI format, clearly separating materials and labor. Provide a sample of the schedule of values for approval ten (10) days prior to submittal of first application.
 - 4. Include all allowances, listed separately (not as a lump sum), on the schedule of values (refer to Section 01 21 00); additionally, include closeout submittals as a line item on the schedule of values (refer to Section 01 78 00).
 - 5. Form 01 29 00-A, Affidavit Certifying Payment to All Subcontractors: Beginning with Application for Payment #2, the Contractor shall submit monthly certification to the Architect indicating payments to subcontractors on prior payment requests. Use Form 01 29 00-A provided herein.
 - 6. Form 01 29 00-B, Affidavit Certifying Davis-Bacon Act Compliance: Beginning with Application for Payment #1, the Contractor shall submit monthly certification to the Architect indicating compliance with the requirements of the Davis-Bacon Act. Use Form 01 29 00-B provided herein.
- B. The Contractor shall deliver with the executed contract a schedule of anticipated payments for the work. This schedule will assist the Owner in financial planning for the construction phase of the project.
- C. The Contractor shall submit each month with the Application for Payment a separate letter either requesting an extension of time or stating that no extension is needed for that period of time. If such letter is not received with the Application for Payment, no extension of time will be considered for the pay period. Complete justification, including weather reports, correspondence, etc., must be included for each day's request for extension. A Contractor's letter or statement will not be considered as adequate justification. The receipt of this request and data by the Owner will not be considered as Owner approval in any way.
- D. The Contractor must submit each month with his Application for Payment an updated construction schedule.
- E. Retainage shall be five percent (5%) of the contract sum. Until final payment, the Owner will pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments. Retainage may be reduced on public projects (as defined by Miss.

Code Ann. §31-3-1) in accordance with the provisions of Miss. Code Ann. §31-5-33. On private projects, retainage will not be reduced prior to final payment.

1.02 MISSISSIPPI SALES TAX

A. Payments for Mississippi sales tax may be made by either of the following methods:

1. Lump sum payment: Prior to payment by the Owner, the Contractor must furnish a receipt as proof of tax payment.
2. Monthly sales tax payment: Prior to payment of sales tax on a monthly basis, the Contractor must furnish proof of a valid Mississippi MPC number for the project.

END OF SECTION

FORM 01 29 00-A

AFFIDAVIT CERTIFYING PAYMENT TO ALL SUBCONTRACTORS

I acknowledge that, pursuant to Miss. Code Ann. § 31-5-25 and H.B. 1562, Laws of 2002, I am required to submit monthly certification indicating payments to subcontractors on prior payments requests. I, the undersigned Contractor, do hereby certify that I have paid the following amounts to subcontractors for work which has been performed and incorporated into previous Applications for Payment which were issued and payment received from the Owner on the project listed below. I understand that this document must be submitted on a monthly basis after the submittal, approval, and payment of Application for Payment #1.

PROJECT NAME: **South Tippah School District**
 Tippah County Technical Center Building Addition
 Ripley, Mississippi
 ARC Project Number ARC-MS-22325

PROJECT NUMBER: **2024520**

Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
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Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____
Subcontractor _____	Amount _____

2024520 – South Tippah School District, Tippah County Technical Center Building Addition

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

Subcontractor _____ Amount _____

(Attach additional list of subcontractors and amounts if necessary.)

Contractor's Name and Title: _____

Contractor's Certificate of Responsibility Number: _____

Contractor's Signature: _____ Date: _____

STATE OF _____

COUNTY OF _____

SWORN AND SUBSCRIBED BEFORE ME, the undersigned notary public, this the _____
day of _____, 20____.

NOTARY PUBLIC

My Commission Expires: _____.

END OF FORM

FORM 01 29 00-B

AFFIDAVIT CERTIFYING DAVIS-BACON ACT COMPLIANCE

I acknowledge that I am required to submit monthly certification regarding compliance with the Davis-Bacon Act, as amended (40 U.S.C. 3141-3148), and as supplemented by Department of Labor regulations (29 CFR Part 5, “Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction”). I understand that, in accordance with the statute, I will be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, I will be required to pay wages not less than once a week. I acknowledge the current prevailing wage determination issued by the Department of Labor as shown in Appendix “B” of the Project Manual (specifications) dated August 13, 2026. I understand that this document must be submitted with each Application for Payment.

PROJECT NAME: **South Tippah School District
Tippah County Technical Center Building Addition
Ripley, Mississippi
ARC Project Number ARC-MS-22325**

PROJECT NUMBER: **2024520**

Attached to this Form 01 29 00-B is the following information with supporting documentation:

- 1) When the undersigned Contractor paid laborers and mechanics.
- 2) The amounts paid by the undersigned Contractor for wages to laborers and mechanics.
- 3) The correct classification for laborers and mechanics.

Contractor’s Name and Title: _____

Contractor’s Certificate of Responsibility Number: _____

Contractor’s Signature: _____ Date: _____

STATE OF _____

COUNTY OF _____

SWORN AND SUBSCRIBED BEFORE ME, the undersigned notary public, this the _____ day of _____, 20____.

NOTARY PUBLIC

My Commission Expires: _____.

END OF FORM

SECTION 01 29 10

WEATHER DELAYS

PART 1 - GENERAL

1.01 EXTENSION OF CONTRACT TIME

- A. An extension of time on the basis of weather may be granted only for the number of weather delay days in excess of the number of days listed as the standard baseline for each specific month.

1.02 STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE

- A. The standard baseline is defined as the normal number of calendar days for each month during which construction activity exposed to weather conditions is expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the standard baseline shall be included in the project schedule and is not eligible for extension of contract time.
- B. The standard baseline is as follows:

January	– 7 Days
February	– 6 Days
March	– 7 Days
April	– 5 Days
May	– 6 Days
June	– 6 Days
July	– 9 Days
August	– 7 Days
September	– 6 Days
October	– 4 Days
November	– 5 Days
December	– 7 Days

1.03 ADVERSE WEATHER AND WEATHER DELAY DAYS

- A. Adverse weather is defined as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents critical path construction activity exposed to weather conditions:
 - 1. Precipitation (rain, snow, or ice) in excess of 0.10" liquid measure.
 - 2. Temperatures that do not rise above that required for the day's construction activity if such temperature requirement is specified or accepted as standard industry practice.
- B. Adverse weather may include, if appropriate, "dry-out" or "mud" days resulting from precipitation days that occur beyond the standard baseline and only if there is a hindrance to the critical path work and the Contractor has taken all reasonable accommodations to avoid such hindrance.

- C. A weather delay day may be counted only if adverse weather prevents work on the critical path.
- D. The Contractor shall take into account that certain construction activities are more affected by adverse weather and seasonal conditions than other activities and that “dry-out” or “mud” days are not eligible to be counted as weather delay days until the standard baseline is exceeded.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 PROJECT SUPERVISION

- A. The Contractor shall employ a competent supervisor and necessary assistants who shall be in attendance at the project site at all times during performance of the work. The project supervisor shall not be moved to another project or otherwise fail to be in attendance at the project site until the project is substantially complete with all punch list items corrected or until the Architect and the Owner approve of the supervisor's absence from the project site.

1.02 PROJECT MEETINGS

- A. Pre-construction conference: A pre-construction conference will be held prior to initiation of the work. A representative from the Contractor and each subcontractor shall attend.
- B. Monthly progress meetings: Monthly progress meetings shall be held during the construction process. The General Contractor shall have a representative at all project meetings. All subcontractors shall be present.

1.03 PRE-INSTALLATION CONFERENCES

- A. Conduct a conference at the project site before each construction activity that requires coordination with other construction. Examples:
 - 1. Cast-in-place concrete.
 - 2. Metal building framing.
 - 3. Masonry.
- B. The installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations shall attend the meeting. Coordinate with the Architect for scheduled meeting dates.
- C. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference.

END OF SECTION

SECTION 01 31 19.16
MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 SCOPE

- A. Mobilization/demobilization consists of moving in, including preparatory work and operations, and moving out, including all dismantling and clean-up work and operations performed by the Contractor.
- B. Mobilization: Includes movement of all labor, equipment, supplies, and incidentals to the project site; establishment of facilities necessary for work on the project; and other work and operations which must be performed or costs not directly attributable to other pay items, exclusive of bidding costs, which must be incurred by the Contractor before beginning and during the early stages of production work on the project site.
- C. Demobilization: Includes movement of all labor, equipment, supplies, and incidentals from the project site; dismantling and removing temporary facilities; clean-up of the project site and all work areas; and other work and operations which must be performed or costs not directly attributable to other pay items which must be incurred by the Contractor after completion of certain items of work and all other work on the Contract has been completed.

1.02 MEASUREMENT

- A. The percentage of the lump sum amount for this item will be measured in accordance with the mobilization/demobilization schedule submitted by the Contractor and approved by the Architect within the following limitations:

<u>% of Total Contract Earned</u>	<u>% of Maximum Lump Sum This Item Allowed</u>
10%	40%
25%	60%
80%	90%

- B. When all work under this Contract is completed by the Contractor and accepted by the Architect, one hundred percent (100%) of the Lump Sum Amount will be allowed.
- C. “Total Contract Earned” will be equal to certified estimates approved by the Architect exclusive of the mobilization/demobilization lump sum and materials stored amounts.

1.03 PAYMENT

- A. Mobilization will be paid for at the Contract Lump Sum Price in accordance with the provisions included under 1.02. This price shall be full compensation for all mobilization and demobilization in accordance with the Contract Documents.

Payment will be made under:

Item 01 31 19.16-A Mobilization/Demobilization per Lump Sum

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 PROJECT RECORD DOCUMENTS

- A. The Contractor shall maintain at the site for the Owner one (1) record copy of the following for general use (maintain these documents in a clean, dry, legible condition; **do not use documents stored at the weatherproof meeting building or trailer in the field**):
1. Contract Drawings.
 2. Specifications.
 3. Addenda: One (1) copy of each addendum shall remain intact and unaltered. Another copy of each addendum shall be cut and taped onto the corresponding page of the plans or specifications. The first Application for Payment will not be approved until this is complete.
 4. Change Orders: The Contractor is responsible for maintaining a complete Change Order log and other modifications to the Contract.
 5. Submittals: The Contractor is responsible for maintaining a set of reviewed shop drawings, product data. and samples.
 6. Test reports: Field test records shall be the responsibility of the Contractor to maintain and log.
 7. Requests for Information (RFIs): The Contractor is responsible for maintaining a concise and complete RFI log.
 - a. The Contractor shall present the RFI log, including all pending RFIs, at each monthly meeting.
 - b. The Contractor is responsible for recording all responses that address and/or resolve RFIs.
 8. Project meeting notes: Project meetings shall be held monthly during the construction process. The Contractor shall have a representative at all project meetings.
 - a. The Contractor shall administer monthly meetings and prepare minutes for distribution to the Architect and the Owner.
- B. The Contractor shall maintain two (2) copies of contract drawings, specifications, and shop drawings for future record. These documents are referred to as “As-Builts.”
1. Mark all modifications in red.

2. Keep record documents current. Update as-built drawings on a daily basis. Do not permanently conceal any work until required information has been recorded.
3. Drawings: Legibly mark to record actual construction.
 - a. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - b. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - c. Field changes in dimension and detail.
 - d. Changes made by Change Order(s) or Construction Change Directive(s).
4. Project Manual and addenda: Legibly mark up each section to record manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
5. Shop drawings: Maintain as record documents. Legibly mark to record any changes made after review.
6. Two (2) copies of “As-Built” are required prior to closeout.

1.02 WORK SCHEDULE

- A. Coordinate the project schedule and operations with the Owner’s requests. Follow the construction schedule as outlined in the Contract Documents.
- B. The Contractor shall at all times conduct his operations as to ensure the least inconvenience to the Owner.
- C. Promptly after being awarded the Contract, the Contractor shall prepare and submit for the Owner’s and the Architect’s information a detailed Contractor’s Construction Schedule for the work. The schedule shall be in bar chart form with a separate line for each significant activity. Review this schedule in form and content and revise to meet the approval of the Architect and the Owner. The schedule shall not exceed time limits established by the Contract Documents.
- D. The Contractor must submit each month with his Application for Payment an updated construction schedule.
- E. If the construction work at any time is delayed or falls behind the schedule as established by the Contractor’s Construction Schedule, the Contractor shall promptly submit a Plan of Recovery which outlines in detail the methods and means required to insure that the project is brought back on schedule. The Contractor’s Plan of Recovery shall address manpower, materials, and coordination efforts as required to successfully implement the Contractor’s Construction Schedule. The Contractor’s Plan of Recovery shall be submitted to the Owner and the Architect for approval not more than five (5) calendar days from the date of the Architect's letter requesting said Plan of Recovery.

- F. The Contractor shall execute Daily Job Reports which address weather conditions, status of indoor/outdoor work, phase of construction, crew sizes/capacity, and subcontractors' work progress. The Contractor's Daily Job Reports shall be submitted to the Owner and the Architect if so requested.

END OF SECTION

SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUBMITTALS

- A. The Contractor shall determine and verify all field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal data with the requirements of the Contract Documents. The Contractor shall verify that the item as submitted is coordinated with other work of the project. The Architect will not review shop drawings unless they bear the Contractor's verification of review and approval.
- B. The Contractor shall furnish the Architect with shop drawings, product data, and samples as outlined in the Architect's submittal requirements. The Architect will furnish the Contractor with submittal requirements at the pre-construction conference.
- C. The Contractor shall provide submittals in electronic (i.e., via e-mail) format.
 - 1. Electronic submittals are permitted on non-finish items only. Finish and color charts shall be submitted in paper format only.
 - 2. Individual specification sections may require additional copies in paper format.
- D. The Contractor shall retain one (1) copy of each submittal on the project site at all times.
- E. All materials that require a color selection shall be submitted (together) before any color selections will be made.
- F. The Architect's review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Review of a specific item shall not include review of an assembly of which the item is a component. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences, and procedures of construction, and coordination of the **work** with that of all other trades and performing all **work** in a safe and satisfactory manner.

1.02 RELATED SECTIONS

- A. Section 00 73 00 – Supplementary Conditions (3.12.9)

1.03 COLOR SELECTION

- A. All submittals that require a color selection shall be submitted together.
- B. The following exterior items require a color selection:
 - 1. Section 04 05 13 – Masonry Mortaring

2. Section 04 21 13 – Brick Masonry
 3. Section 07 72 00 – Roof Accessories
 4. Section 09 91 00 – Painting
 5. Section 10 73 13 –Awnings
 6. Section 13 34 19 – Metal Building Systems
- C. The following interior items require a color selection:
1. Section 09 30 13 – Ceramic Tiling
 2. Section 09 65 13.13 – Resilient Base
 3. Section 09 65 19 – Resilient Tile Flooring
 4. Section 09 91 00 – Painting
 5. Section 10 14 15 – Interior Signage
 6. Section 12 21 00 – Window Blinds

END OF SECTION

SECTION 01 45 23
TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Work included:

1. Testing and inspections as described in various sections of the Project Manual (Divisions 1 through 48, including all Appendices) and/or elsewhere in the Construction Documents.
2. Testing and inspection as described in Chapter 17 – Special Inspections and Tests of the 2018 International Building Code.
3. Testing and inspection required by local, municipal, state, and federal codes.
4. Cooperate with selected testing agencies and all others responsible for testing and inspecting work.
5. Testing and inspecting as specified to be furnished by the Owner-selected testing agent in this section and/or elsewhere in the Construction Documents.
6. Coordination of testing and inspection as noted in this section and/or elsewhere in the Construction Documents shall be by the Contractor and/or subcontractors.

B. Related sections affecting the work of this section include but is not limited to:

1. General Conditions.
2. Section 00 73 00 – Supplementary Conditions.
3. Division 1.
4. Division 2.
5. Division 3.
6. Division 4.
7. Division 5.
8. All other sections related to the inspection required by Chapter 17 of the 2018 International Building Code.

C. Related work:

1. Additional requirements for testing may be described in various sections of these specifications.

2. Where no testing requirements are described, but the Owner decides that testing is required, the Owner may require such testing to be performed under current pertinent standards for testing. Payments for such testing will be made as described in this section.

1.02 SELECTION OF TESTING LABORATORY AND INSPECTORS

- A. The Owner will select an independent testing laboratory and inspectors for the testing and inspection of all work related with:
 1. Division 2.
 2. Division 3.
 3. Division 4.
 4. Division 5.
 5. Inspections required by Chapter 17 of the 2018 International Building Code.
- B. All other testing and inspections as described in various sections of this Project Manual (Divisions 1 through 48 including all Appendices) and/or elsewhere in the Construction Documents and required by local, municipal, state, and federal codes shall be furnished by the Contractor at no additional cost to the Owner.

1.03 PAYMENT FOR TESTING AND INSPECTION

- A. Payment for testing and inspection shall be as follows:
 1. Payment for testing and inspection related to Division 2, Division 3, Division 4, Division 5, and inspections required by Chapter 17 of the 2018 International Building Code shall be as follows:
 - a. Payment for initial testing and inspection shall be by allowance except as noted elsewhere. Refer to Section 01 21 00 – Allowances.
 - b. Payment for initial testing and inspection shall be made by the Contractor except as noted elsewhere.
 - c. Payment for re-testing and/or re-inspection shall be made by the Contractor.
 2. Payment for all other testing and inspections as described in various sections of this Project Manual (Divisions 1 through 48 including all Appendices) and/or elsewhere in the Construction Documents and required by local, municipal, state, and federal codes shall be by the Contractor.
- B. When initial tests and inspections indicate non-compliance for Division 2, Division 3, Division 4, Division 5, inspections required by Chapter 17 of the 2018 International Building Code, all other testing and inspections as described in various sections of this Project Manual (Divisions 1 through 48 including all Appendices) and/or elsewhere in

the Construction Documents, and inspections required by local, municipal, state, and federal codes, subsequent re-testing and/or re-inspection occasioned by the non-compliance shall be performed by the same testing and/or inspecting agency. The cost for re-testing and re-inspection shall be paid by the Contractor.

- C. Re-testing and re-inspection shall be carried out without change in the Contract Sum or Contract Time.
- D. All work required to be performed prior to re-testing and/or re-inspection shall be carried out without change in the Contract Sum or Contract Time.
- E. When the testing laboratory and/or inspection agency is ready to test according to the established schedule but is prevented from testing, taking specimens, or inspecting due to incompleteness of the work, all extra costs attributable to the delay shall be paid by the Contractor.

1.04 QUALITY ASSURANCE

- A. The testing laboratory shall be qualified in accordance with ASTM E329.
- B. Testing, when required, shall be in accordance with all pertinent codes and regulations and with selected standards of the American Society of Testing and Materials.
- C. Testing and inspection shall be performed in strict accordance as required by Chapter 17 of the 2018 International Building Code, by various sections of the Project Manual (Divisions 1 through 48 including all Appendices) and/or elsewhere in the Construction Documents, and by local, municipal, state, and federal codes.

1.05 REPORTS

- A. Promptly process and distribute required copies of test and/or inspection reports and related instruction to assure necessary re-testing, re-inspection, and/or replacement of materials.
- B. Required reports:
 - 1. Provide one (1) printed copy and one (1) digital (PDF) copy of the reports to the Owner, Architect, and the Contractor.
 - 2. Provide all other reports as required.
- C. The Contractor shall be responsible for distribution of all testing and certification compliance reports.

1.06 CODE COMPLIANCE TESTING AND INSPECTIONS

- A. Tests and inspections required by codes or ordinances or by plan approval authority and which are made by a legally constituted authority shall be the responsibility of and shall be paid for by the Contractor unless otherwise provided in the Construction Documents.

1.07 CONTRACTOR’S CONVENIENCE TESTING AND INSPECTION

- A. Inspection and tests performed exclusively for the Contractor’s convenience shall be the sole responsibility of the Contractor and the cost for said convenience testing and inspection shall be by the Contractor.

1.08 TAKING SPECIMENS

- A. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel shall be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory shall be performed by the testing laboratory.

1.09 SCHEDULES FOR TESTING AND INSPECTION

- A. By advance discussion with the testing laboratory and inspection agencies, determine the time required for the laboratory and inspectors to perform their tests and inspections and to issue reports for each of their findings.
- B. All required time for testing, inspection, re-testing, and re-inspection and all work required to be performed prior to re-testing and/or re-inspection shall be carried out within the Contract Time.
- C. When changes of the construction schedule are necessary during construction, coordinate all such changes with the testing laboratory and inspection agencies as required not less than forty-eight (48) hours prior to any scheduled testing or inspection.
- D. The Contractor shall notify the Architect not less than forty-eight (48) hours prior to any required testing or inspection.
- E. The Contractor shall notify the testing laboratory and/or inspection agencies as required prior to any required testing and/or inspection to allow time for scheduling personnel and materials.

PART 2 - PRODUCTS

2.01 CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS

- A. Required verification and inspection of steel construction (2018 IBC Table 1704.3):
 - 1. Material verification of high-strength bolts, nuts, and washers:
 - a. Identification of markings to conform to ASTM standards specified in the approved Construction Documents.
 - 1) Frequency: Periodic verification and inspection.
 - 2) Referenced standard: Applicable ASTM material specifications; AISC 360, Section A3.3.
 - b. Manufacturer’s certificate of compliance is required.

- 1) Frequency: Periodic verification and inspection.
2. Inspection of high-strength bolting:
 - a. Bearing-type connections.
 - 1) Frequency: Periodic verification and inspection.
 - 2) Referenced standard: AISC 360, Section M2.5.
 - 3) IBC reference: 2018 IBC Sec. 1704.3.3.
 - b. Slip-critical connections.
 - 1) Frequency: Continuous and periodic verification and inspection.
 - 2) Referenced standard: ASIC 360, Section M2.5.
 - 3) IBC reference: 2018 IBC Sec. 1704.3.3.
3. Material verification of structural steel:
 - a. Identification markings shall conform to ASTM standards specified in the approved Construction Documents.
 - 1) Referenced standard: ASTM A6 or ASTM A568.
 - 2) IBC reference: 2018 IBC Sec. 1708.4.
 - b. Manufacturers' certified mill test reports.
 - 1) Referenced standard: ASTM A6 or ASTM A568.
 - 2) IBC reference: 2018 IBC Sec. 1708.4.
4. Material verification of weld filler materials:
 - a. Identification markings shall conform to AWS specifications in the approved Construction Documents.
 - 1) Referenced standard: AISC 360, Section A3.5.
 - b. Manufacturer's certificate of compliance is required.
5. Inspection of welding:
 - a. Structural steel: Complete and partial penetration groove welds.
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: AWS D1.1.
 - 3) IBC reference: 2018 IBC Sec. 1704.3.1.

- b. Structural steel: Multi-pass fillet welds.
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: AWS D1.1.
 - 3) IBC reference: 2018 IBC Sec.1704.3.1.
- c. Structural steel: Single-pass fillet welds $> 5/16"$.
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: AWS D1.1.
 - 3) IBC reference: 2018 IBC Sec. 1704.3.1.
- d. Structural steel: Single-pass fillet welds $\leq 5/16"$.
 - 1) Frequency: Periodic verification and inspection.
 - 2) Referenced standard: AWS D1.1.
 - 3) IBC reference: 2018 IBC Sec. 1704.3.1.
- e. Reinforcing steel: Verification of weldability of reinforcing steel other than ASTM A706.
 - 1) Frequency: Periodic verification and inspection.
 - 2) Referenced standard: AWS D1.4; ACI 318: 3.5.2.
- f. Reinforcing steel: Reinforcing steel-resisting flexural and axial forces in intermediate and special moment frame and boundary elements of special reinforced concrete shear walls and shear reinforcement.
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: AWS D1.4; ACI 318: 3.5.2.
- g. Reinforcing steel: Shear reinforcement.
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: AWS D1.4; ACI 318: 3.5.2.
- h. Reinforcing steel: Other reinforcing steel.
 - 1) Frequency: Periodic verification and inspection.
 - 2) Referenced standard: AWS D1.4; ACI 318: 3.5.2.

6. Inspection of steel frame joint details for compliance with the approved Construction Documents:
 - a. Detail such as bracing and stiffening.
 - 1) Frequency: Periodic verification and inspection.
 - 2) IBC reference: 2018 IBC Sec. 1704.3.3.
 - b. Member location:
 - 1) Frequency: Periodic verification and inspection.
 - 2) IBC reference: 2018 IBC Sec. 1704.3.3.
 - c. Application of joint detail at each connection:
 - 1) Frequency: Periodic verification and inspection.
 - 2) IBC reference: 2018 IBC Sec. 1704.3.3.
- B. Required verification and inspection of concrete construction (IBC 2018 Table 1704.4):
 1. Inspection of reinforcing steel, including pre-stressing tendons, and placement.
 - a. Frequency: Periodic verification and inspection.
 - b. Referenced standard: ACI 318: 3.5, 7.1-7.7.
 - c. IBC reference: 2018 IBC Sec. 1913.4.
 2. Inspection of reinforcing steel welding in accordance with 2018 IBC Table 1704.3, Item 5b.
 - a. Referenced standard: AWS D1.4; ACI 318: 3.5.2.
 3. Inspection of bolts to be installed in concrete prior to and during placement of concrete where allowable loads have been increased:
 - a. Frequency: Continuous verification and inspection.
 - b. IBC reference: 2018 IBC Sec. 1911.5.
 4. Verifying use of required design mix:
 - a. Frequency: Periodic verification and inspection.
 - b. Referenced standard: ACI 318: Ch 4, 5.2-5.4.
 - c. IBC reference: 2018 IBC Sec. 1904.2, 1913.2, 1913.3.

5. At the time fresh concrete is sampled to fabricate specimens for strength test, to perform slump and air content test, and to determine the temperature of the concrete:
 - a. Frequency: Continuous verification and inspection.
 - b. Referenced standard: ASTM C172; ASTM C31; ACI 318: 5.6, 5.8.
 - c. IBC reference: 2018 IBC Sec. 1913.10.
6. Inspection of concrete placement for proper application techniques:
 - a. Frequency: Continuous verification and inspection.
 - b. Referenced standard: ACI 318: 5.9, 5.10.
 - c. IBC reference: 2018 IBC Sec. 1913.6, 1913.7, 1913.8.
7. Inspection for maintenance of specified curing temperature and techniques:
 - a. Frequency: Periodic verification and inspection.
 - b. Referenced standard: ACI 318: 5.11-5.13.
 - c. IBC reference: 2018 IBC Sec. 1913.9.
8. Inspection of pre-stressed concrete:
 - a. Application of pre-stressing forces:
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: ACI 318: 18.20; ACI 318: 18.18.4.
 - b. Grouting of bonded pre-stressing tendons in the seismic force-resisting system:
 - 1) Frequency: Continuous verification and inspection.
 - 2) Referenced standard: ACI 318: 18.20; ACI 318: 18.18.4.
9. Verification of in-situ concrete strength, prior to stressing of tendons in posttensioned concrete and prior to removal of shores and forms from beams and structural slabs:
 - a. Frequency: Periodic verification and inspection.
 - b. Referenced standard: ACI 318: 6.2.
10. Inspection of formwork for shape, location, and dimensions of the concrete members being formed:

- a. Frequency: Periodic verification and inspection.
 - b. Referenced standard: ACI 318: 6.1.1.
- C. Level 1 special inspection (2018 IBC Table 1704.5.1):
- 1. As masonry construction begins, the following shall be verified to ensure compliance:
 - a. Proportions of site-prepared mortar:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 2.6A.
 - b. Construction of mortar joints:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.3B.
 - c. Location of reinforcement, connectors, pre-stressing tendons, and anchorages:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.4, 3.6A.
 - d. Pre-stressing technique:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.6B.
 - e. Grade and size of pre-stressing tendons and anchorages:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 2.4B, 2.4H.
 - 2. The inspection program shall verify the following:
 - a. Size and location of structural elements:
 - 1) Frequency: Periodic inspection.

- 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.3G.
 - b. Type, size, and location of anchorage of masonry to structural members, frames, or other construction:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530 / ASCE 5 / TMS 402: Sec. 1.2.2(e), 2.1.4, 3.1.6.
 - c. Specified size, grade, and type of reinforcement:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530 / ASCE 5 / TMS 402: Sec. 1.13.
 - 3) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 2.4, 3.4.
 - d. Protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F):
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: 2018 IBC Sec. 2104.3, 2104.4.
 - 3) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 1.8C, 1.8D.
 - e. Application and measurement of pre-stressing force:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.6B.
3. Prior to grouting, the following shall be certified to ensure compliance:
 - a. The grout space is clear.
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.2D.
 - b. Placement of reinforcing and connectors and pre-stressing tendons and anchorages:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530 / ASCE 5 / TMS 402: Sec. 1.13.

- 3) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.4.
 - c. Proportions of site-prepared grout and pre-stressing grout for bonded tendons:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 2.6B.
 - d. Construction of mortar joints:
 - 1) Frequency: Periodic inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.3B.
 - 4. Grout placement shall be verified to ensure compliance with code and Construction Documents provisions.
 - 1) Frequency: Continuous inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.5.
 - b. Grouting of pre-stressing bonded tendons:
 - 1) Frequency: Continuous inspection.
 - 2) Reference for criteria: ACI 530.1 / ASCE 6 / TMS 602: Art. 3.6C.
- D. Required verification and inspection of soils (2018 IBC Table 1704.7):
- 1. Verify that materials below footings are adequate to achieve the design-bearing capacity.
 - a. Frequency: Periodic verification and inspection.
 - 2. Verify that excavations are extended to the proper depth and that they have reached the proper material.
 - a. Frequency: Periodic verification and inspection.
 - 3. Perform classification and testing of controlled fill materials.
 - a. Frequency: Periodic verification and inspection.
 - 4. Verify the use of the proper materials, densities, and lift thicknesses during placement and compaction of controlled fill.
 - a. Frequency: Continuous verification and inspection.

5. Prior to placement of controlled fill, observed the subgrade and verify that the site has been prepared properly.

a. Frequency: Periodic verification and inspection.

E. Other required verification and inspection as applicable to the scope of the project.

2.02 OTHER TESTING AND INSPECTION

A. Testing and inspections as required and described in various sections of this Project Manual (Divisions 1 through 48 including all Appendices) and/or elsewhere in the Construction Documents.

B. Testing and inspections as required by local, municipal, state, and federal codes.

PART 3 - EXECUTION

3.01 COOPERATION WITH TESTING LABORATORY AND INSPECTION AGENCIES

A. Representatives of the testing laboratory and inspection agencies shall have safe access to the work at all times and at all locations where the work is in progress.

END OF SECTION

SECTION 01 52 00
CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.01 JOB SITE OFFICE

- A. The Contractor shall provide a weatherproof meeting building or trailer to house the Contract Documents and records.
 - 1. This facility shall be complete with lighting, heat, and telephone.
 - 2. This facility shall be available to the Owner, the Architect, and their representatives during working hours.
- B. The Contractor is encouraged to provide a computer with internet access at the job site office.
- C. The Contractor is required to provide a digital camera and internet connection at the job site office for the transmission of progress photographs to the Architect, as well as to receive e-mail communication regarding the project.
- D. The Contractor is required to provide the job superintendent with a cellular telephone for use during normal working hours.

END OF SECTION

SECTION 01 56 26
TEMPORARY FENCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. As a minimum means of protection, security, and enclosure, provide and install temporary construction fence at the primary limit of the work to restrict access and control traffic.
2. The Contractor shall install additional fencing of a type determined by the Contractor to increase protection, security, and enclosure as the Contractor deems necessary.

B. Related sections:

1. Section 01 52 00 – Construction Facilities

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Posts: 2 x 4 stakes at 8'-0" o.c. or metal stakes with protective end caps.
- B. Fence fabric: Equal to Polybarrier, rolled fencing.
- C. Fence height: 4'-0".
- D. Color: Orange.

2.02 GATES

- A. Construct gates to match fence construction.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Confirm locations and avoid underground utilities.

3.02 REMOVAL

- A. Remove temporary fencing upon substantial completion of the project.

END OF SECTION

SECTION 01 58 00
PROJECT IDENTIFICATION

PART 1 - GENERAL

1.01 PROJECT SIGN

- A. The General Contractor shall erect on adequate supports and maintain one (1) neatly constructed and painted $\frac{3}{4}$ " thick plywood sign approximately 8' x 8'. The Architect will provide colors, lettering, layout, and location of the sign.
- B. No other signs shall be displayed on the job site without permission of the Architect. The display of sign advertisements is strictly prohibited.

END OF SECTION

SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.01 CUTTING AND PATCHING

- A. Execute cutting, fitting, and patching to complete the work and to:
 - 1. Fit the several parts together, to integrate with other work.
 - 2. Uncover work to install ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to the Contract Documents.
 - 5. Install specified work in existing construction.
 - 6. Provide openings for penetrations of mechanical and electrical work.
- B. Do not cut or alter work of another Contractor without permission.
- C. Take special care to insure that penetrations of rated walls and ceilings are not oversized.
- D. Costs caused by ill-timed or defective work or work not conforming to the Contract Documents shall be borne by the party responsible for the ill-timed, defective, or non-conforming work.
- E. Exercise care not to damage existing buildings, paving, and landscaping scheduled to remain. Repair or replace items damaged during the construction process.

1.02 EXECUTION

- A. Inspect existing conditions of work, including elements subject to movement or damage during cutting and patching.
- B. Provide shoring, bracing, and support, as required, to maintain the structural integrity of the building. Provide protection for other portions of work and protection from the elements.
- C. Execute cutting and demolition by methods which prevent damage to other work and which will provide surfaces to receive installation of repairs and new work.
- D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.
- E. Refinish entire surfaces, as necessary, to provide an even finish. Refinish continuous surfaces to the nearest intersection. Refinish assemblies in their entirety.

1.03 MOISTURE CONTROL

- A. Wet materials shall not be installed.

END OF SECTION

SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.01 FINAL CLEANING

A. Buildings and other improvements:

1. In addition to removal of debris and cleaning of specified materials in other sections, clean interior exposed-to-view surfaces.
2. Remove temporary protection and labels not required to remain.
3. Clean finishes free of dust, stains, films, and other foreign substances.
4. Clean transparent and glossy materials to a polished condition; remove foreign substances. Polish reflective surfaces to a clear shine.
5. Clean surfaces of equipment; remove excess lubrication.
6. Clean plumbing fixtures to a sanitary condition.
7. Clean permanent filters of ventilating equipment and replace disposable filters; in addition, clean ducts, blowers, and coils.
8. Clean light fixtures and lamps.
9. Remove waste, foreign matter, and debris from roofs, drainage systems, and site area.
10. Clean and polish hardware to a glossy finish.

B. Site:

1. Remove waste, debris, and surplus materials from the site. Clean grounds; remove stains, spills, and foreign substances from paved areas and sweep clean.
2. Sweep and remove stains from all new paving and walks.

END OF SECTION

SECTION 01 75 00
STARTING AND ADJUSTING

PART 1 - GENERAL

1.01 STARTING SYSTEMS

- A. Coordinate the schedule for the start-up of various equipment and systems:
 - 1. HVAC equipment.
 - 2. Electrical generator.
- B. Execute start-up under the supervision of the responsible Contractor's personnel in accordance with the manufacturer's instructions.
- C. Demonstrate operation and maintenance of products to the Owner's personnel prior to the date of substantial completion.
- D. Utilize operation and maintenance manuals as the basis for instruction. Review contents of manuals with the Owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Submit a written report that equipment or system has been properly installed and is functioning and list persons in attendance at the demonstration.

END OF SECTION

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.01 SPARE PARTS, MAINTENANCE MATERIALS, AND MANUALS

- A. Provide products, spare parts, and maintenance materials in the quantities specified in each section in addition to that used for construction of the work. Coordinate with the Owner, deliver to the project site, and obtain receipt prior to final payment.
- B. Provide complete list with addresses and telephone numbers of subcontractors and work performed on the project. Bind said list with submittals, warranties, and instructional data relating to the project.

1.02 PROJECT CLOSEOUT

- A. Include closeout submittals as a line item on the schedule of values.
 - 1. Payment for this line item will not be made until closeout submittals are completed and approved.
 - 2. This line item shall be \$5,000.00.
- B. The Contractor shall furnish to the Architect copies of the following in two (2) three-ring binders with submission of the final Application for Payment (**unless indicated otherwise, all documents must be originals**):

<u>Item Description</u>	<u>Initiator</u> C=Contractor A=Architect	<u>Qty</u>	<u>Date Completed</u>
1. Contractor's Written Request for Final Inspection	C	2	
2. Results of Owner's Inspection (Punch List)	A	2	
3. Contractor's Written Statement: Punch List Completed	C	2	
4. Copies of Field Orders	A	2	
5. Copies of Change Orders (AIA G701)	A	2	
6. Copies of the Certificate of Substantial Completion (AIA G704)	A	2	
7. Contractor's Affidavit of Payment of Debts and Claims (AIA G706)	C	2	
8. Contractor's Affidavit of Release of Liens (AIA G706A)	C	2	
9. Consent of Surety to Final Payment (AIA G707)	C	2	
10. Contractor's Statement: Utility Payments Settled	C	2	
11. Assessment of Liquidated Damages (if	A	2	

applicable)			
12. Contractor's Certification of Non-Use of Asbestos-Containing Building Materials	C	2	
13. Architect's Certification of Non-Specification of Asbestos-Containing Building Materials	A	2	
14. Names and Addresses of Subcontractors	C	2	
15. Contractor's Guarantee of Work: Letter (confirm provisions as outlined in Section 01 78 36 – Warranties)	C	2	
16. Special Guarantees Applicable to Definite Parts of the Work	C	2	
17. Product Data Sheets and Maintenance, Operating, and Procedural Manuals (for example: metal, roof and flashing systems, mechanical systems, electrical systems, etc.)	C	2	
18. Project Record Documents (As-Builts)	C	2	

END OF SECTION

SECTION 01 78 36

WARRANTIES

PART 1 - GENERAL

1.01 WARRANTY

- A. All work performed under this Contract shall be free from defects in workmanship and materials for a period of one (1) year from the date of substantial completion of the project or the portion thereof designated in the Certificate of Substantial Completion. The date of commencement of warranties for items on the list of items to be completed or corrected and attached to the Certificate of Substantial Completion will be the date of final payment.
- B. Some work performed under this Contract shall have a warranty period that exceeds one (1) year; refer to specific specification sections.
- C. During the warranty period, labor, materials, and services required to repair defects and damages shall be the responsibility of the Contractor.
- D. Light bulbs are excluded from the one-year warranty period.
- E. Contractor's warranty statement:
 - 1. The Contractor and the Contractor's Surety hereby guarantee that all work performed on the project is free from defective and/or nonconforming materials and workmanship and that, for a period of one (1) year from the date of final completion or such longer period of time as may be called for in the Contract Documents for such portions of the work, the Contractor or its Surety will repair and/or replace any defective and/or nonconforming materials and workmanship in accordance with the requirements of the Contract Documents.
 - 2. All warranties or guarantees with respect to all appliances, machinery, and equipment installed in the work by the Contractor or any subcontractor, supplier, and manufacturer are hereby assigned to the Owner, and the Owner is hereby subrogated to all of the same.

END OF SECTION

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor and materials necessary to complete all demolition work shown on the drawings and as specified and as required to accomplish all new work specified herein.
- B. Remove designated doors, frames, partitions, ceilings, mechanical, electrical, and miscellaneous building components as specified herein and as indicated on the drawings and as required to accomplish all new work specified herein.
- C. Refer to mechanical and electrical specifications and drawings and general demolition plans. Mechanical and electrical subcontractors are to cap and identify existing utility lines.
- D. Take care to avoid damaging existing building(s) and elements shown to remain.
- E. Provide and install temporary bracing as necessary to ensure the structural stability of load-bearing elements. Provide and install wood blocking as specified herein and as indicated on the drawings.
- F. Take care to include work described in general and specific demolition notes on the drawings.
- G. Take care to avoid damaging existing building windows.
- H. Remove and dispose of all debris, waste, and surplus materials whether generated by the demolition process or existing.

1.02 RELATED WORK

- A. Section 06 10 00 – Rough Carpentry
- B. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
- C. Division 26 – Electrical
- D. Division 27 – Communications
- E. Division 28 – Electronic Safety and Security

1.03 EXISTING CONDITIONS

- A. Conduct demolition to minimize interference with adjacent building areas. Maintain protected egress and access at all times.

1.04 DISPOSAL OF DEBRIS

- A. Remove debris on a daily basis. Do not stockpile waste and debris.
- B. Dispose of all debris in a manner that complies with all municipal, state, and federal regulations.
- C. Pay any and all fees associated with debris disposal.

PART 2 - PRODUCTS

2.01 SALVAGE MATERIALS AND EQUIPMENT

- A. Materials and equipment scheduled to be removed (and not re-used) shall become the property of the General Contractor unless specifically designated in the Construction Documents.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Erect and maintain weatherproof closures for exterior openings.
- B. Erect and maintain temporary partitions to prevent the spread of dust.
- C. Protect existing items not scheduled for alteration.
- D. Disconnect, remove, and cap designated utility services within demolition areas.
- E. Take special care to protect wall, ceiling, and floor finishes scheduled for re-use.
- F. Prior to demolishing designated walls and partitions, investigate the weight-bearing characteristics. Provide and install temporary shoring and permanent framing to permit the removal of load-bearing elements. Notify the Professional immediately if partitions scheduled for removal appear to be load-bearing.
- G. Mark the locations of disconnected utilities. Identify and indicate capping locations on Project Record Documents.
- H. No sandblasting will be permitted for any reason.
- I. Staging area:
 - 1. The Contractor must enclose and secure the entire staging area with construction fencing. Protect existing plant materials within the staging area. No parking or staging is permitted within the drip line of any tree.
 - 2. The Contractor shall construct suitable chutes for the conveyance of debris from heights above 8'-0".
 - 3. The Contractor is responsible for maintaining traffic control within limits of the work.

3.02 EXECUTION

- A. Demolish in an orderly and careful manner. Protect existing supporting structural members. Do not alter any structural elements without prior approval of the Professional.
- B. Except where noted otherwise, immediately remove demolished materials from the site.
- C. Remove materials to be re-installed or retained in a manner to prevent damage.
- D. Remove and promptly dispose of any contaminated, vermin-infested, or dangerous materials.
- E. Do not burn or bury materials on site.
- F. Remove demolished materials from the site as work progresses. Upon completion of work, leave areas of work in clean condition.
- G. The Contractor is responsible for strict compliance with all applicable state laws, municipal ordinances, and the rules and regulations of state agencies having jurisdiction over demolition procedures.
- H. The Contractor is responsible for payment of any and all fees associated with the disposal of demolished materials.
- I. Execute cleaning work as required to remove all dust and debris generated by the demolition work.
- J. Any trade that requires a trench or a ditch shall be responsible for excavating the trench or ditch, disposing of associated debris, filling the trench or ditch, and compacting it as required for finalizing the surface, whether paving or sod. Disturbed paved areas shall be patched by the General Contractor.
- K. Concrete cutting shall be performed so as to minimize opening sizes as required for each penetration. Drill pilot holes to locate openings. Locate openings to avoid conflicts with reinforcing steel wherever possible. Core-drill or saw-cut openings. Use of pneumatic air hammers or jackhammers is not permitted.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Formwork for cast-in-place concrete with shoring, bracing, and anchorage.
 - 2. Openings for other work.
 - 3. Form accessories.
 - 4. Stripping of forms.
- B. Related sections:
 - 1. Section 03 20 00 – Concrete Reinforcing
 - 2. Section 03 30 00 – Cast-In-Place Concrete

1.02 REFERENCES

- A. ACI 301 – Specifications for Structural Concrete for Buildings.
- B. ACI 347 – Recommended Practice for Concrete Formwork.
- C. PS 1 – Construction and Industrial Plywood.

1.03 SCOPE OF WORK

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements so that the resultant concrete conforms to the required shapes, lines, and dimensions.

1.04 QUALITY ASSURANCE

- A. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the General Contractor and shall be in accordance with ACI 301 and ACI 347.
- B. Design formwork for loads, lateral pressures, and allowable stresses outlined in Sections 102 and 103 of ACI 347 and wind loads so specified by the governing building code.
- C. Forms shall conform to the shapes, lines, and dimensions of the members as called for on the plans and shall be constructed as to ensure that the concrete surfaces will conform to the tolerances of ACI 347, Section 203.1.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Plywood: PS-1, MDO or BB grade, Class 1.
- B. Lumber: Southern Yellow Pine species; #3 S4S grade; with grade stamp clearly visible. Use only on unexposed surfaces.
- C. Formwork for round columns and cylindrical sections shall be equal to Sonotube.

2.02 ACCESSORIES

- A. Form release agent: Colorless materials which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.
- B. Nails, spikes, lag bolts, through bolts, anchorages: Sized as required; of strength and character to maintain formwork in place while concrete is placed.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and measurements before proceeding with formwork.

3.02 PREPARATION

- A. Hand-trim sides and bottoms of earth form; remove loose dirt prior to placing concrete.
- B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- C. Arrange and assemble formwork to permit stripping so that concrete is not damaged during its removal.
- D. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- E. Thin form-coating compounds only with thinning agent of type, and in amount, and under the conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with the manufacturer's instructions.

3.03 ERECTION

- A. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.
- B. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surface and adjacent materials.

- C. Construct forms to sizes, shapes, lines, and dimensions shown. Construct forms to obtain accurate alignment, locations, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
- E. Do not displace or damage moisture barriers or waterproofing.

3.04 APPLICATION

- A. Apply form release agent on formwork in accordance with the manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.
- B. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.05 INSERTS AND EMBEDDED PARTS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Install accessories in accordance with the manufacturer's instructions, level and plumb. Ensure that items are not disturbed during concrete placement.
- C. Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete.
- D. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Take care to recess slabs at brick porches.

3.06 CLEANING

- A. Clean forms to remove foreign matter as erection proceeds.
- B. During cold weather, remove ice and snow from forms. Do not use de-icing salts.
- C. Cleaning and tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove wood, chips, sawdust, dirt, or other debris just before concrete is placed.

3.07 SHORE AND SUPPORTS

- A. Comply with ACI 347 for shoring and reshoring and as herein specified.
- B. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work without excessive stress or deflection.

- C. Keep reshores in place a minimum of fifteen (15) days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

3.08 FORM REMOVAL

- A. Do not remove forms and bracing until concrete has sufficient strength to support its own weight and that of construction and design loads which may be imposed upon it.
- B. Reshore structural members due to design requirements or construction conditions to permit successive construction.
- C. Do not damage concrete surfaces during form removal.
- D. Formwork not supporting the weight of concrete may be removed after cumulatively curing at not less than 50° F for twenty-four (24) hours after placing concrete, provided that the concrete is sufficiently hard to not be damaged by form removal operations and provided that curing and protection operations are maintained.
- E. Formwork supporting the weight of concrete may not be removed in less than fourteen (14) days and until concrete has attained 70% of the minimum design compressive strength at twenty-eight (28) days. Determine the potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

3.09 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new form work.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete and masonry.

1.02 REFERENCES

- A. ACI 301 – Specifications for Structural Concrete for Buildings.
- B. ACI 315 – Details and Detailing of Concrete Reinforcement.
- C. ANSI/ASTM A82 – Cold Drawn Steel Wire for Concrete Reinforcement.
- D. ANSI/ASTM A185 – Welded Steel Wire Fabric for Concrete Reinforcement.
- E. ASTM A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- F. CRSI – Manual of Practice.
- G. CRSI 63 – Recommended Practice for Placing Reinforcing Bars.
- H. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.03 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with the CRSI Manual of Standard Practice and Documents 63 and 65.
- B. Conform to ACI 315.
- C. Acceptable manufacturers: Regularly engaged in the manufacture of steel bars and welded wire fabric.
- D. Installers' qualifications: Three (3) years of experience in the installation of steel bar and welded wire reinforcing.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcing to the project site in bundles marked with metal gages indicating the contents of each bundle keyed to the fabrication schedule.
- B. Handle and store materials to prevent contamination and deterioration.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing steel: ASTM A615, 40 and 60 yield grade billet-steel deformed bars, uncoated finish.
 - 1. #3 ties and stirrups shall be Grade 40.
 - 2. All other shall be Grade 60.
- B. Welded steel wire fabric: ANSI/ASTM A185 plain type; in flat rolls; uncoated finish.

2.02 ACCESSORY MATERIALS

- A. Tie wire: Minimum 18 gage annealed type.

2.03 FABRICATION

- A. Fabricate in accordance with ACI 315, providing the concrete cover specified in Section 03 30 00.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with the Concrete Reinforcing Steel Institute's "Recommended Practice for Placing Reinforcing Bars" for details and methods of reinforcement placement and supports and as herein specified.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials which reduce or destroy bond with concrete.
- C. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so the ends are directed into concrete, not toward exposed concrete surfaces.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The Contractor shall furnish all labor, materials, form-work equipment, and services required to complete all the concrete work shown on the drawings and specified herein, including all sidewalks, concrete pavement, curbs, foundations and slabs.
- B. Cast-in-place slabs and paving.
- C. Cast-in-place concrete footings.
- D. Cast-in-place concrete sidewalks.

1.02 REFERENCES

- A. ACI 301 – Specifications for Structural Concrete for Buildings.
- B. ASTM C33 – Concrete Aggregate.
- C. ASTM C94 – Ready-Mixed Concrete.
- D. ASTM C150 – Portland Cement.
- E. ASTM C260 – Air-Entraining Admixtures for Concrete.
- F. ASTM C494 – Chemical Admixtures for Concrete.

1.03 QUALITY ASSURANCE

- A. Codes and standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified.
 - 1. ACI 318 “Building Code Requirements for Reinforced Concrete.”
 - 2. ACI 318 “Manual of Standard Practice for Detailing Reinforced Concrete Structures.”
- B. The ready-mixed concrete plant shall be certified for conformance with the requirements of the National Ready Mixed Concrete Association.
- C. Slump (ASTM C143): One (1) test for each concrete load at point of discharge and one (1) test for each set of compressive strength test specimens. The Contractor and the testing service are responsible for taking slump tests and adjusting water volume.
- D. Air content (ASTM C173): Volumetric method for normal weight of discharge and one (1) test for each set of compressive strength test specimens.

- E. Concrete temperature: Test hourly when the air temperature is 40° F and below, when the air temperature is 80° F and above, and each time a set of compression test specimens are made.
- F. Compression test specimens (ASTM C31): One (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory testing.
- G. Compressive strength tests (ASTM C31): One (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory testing.
 - 1. Test results will be reported in writing to the Architect and the Contractor. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day tests and 28-day tests. The 7-day test results shall be considered satisfactory only if they equal 70% of the 28-day design requirement.
 - 2. Additional tests: The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strength and other characteristics have not been attained in the structure, as directed by the Architect. The testing service may conduct tests to determine the adequacy of concrete by cored cylinders complying with ASTM C42 or by methods as directed. The Contractor shall pay for all tests conducted and any other additional testing as may be required when unacceptable concrete is verified.

1.04 TESTS

- A. An independent testing laboratory selected by the Owner shall perform the following services:
 - 1. Field and control cylinders shall be cast, cured, and tested for each pour. Cylinders are to be cast on the job according to ASTM C31 and laboratory tests will follow ASTM C39.
 - 2. A set of four (4) cylinders or six (6) during winter shall be made per pour when placing concrete for every pour from 0-50 yards and/or increment thereof; all of these cylinders shall be placed in a moist curing room and left therein until tested. Two (2) cylinders shall be tested at seven (7) days and two (2) cylinders at twenty-eight (28) days or as directed.
 - 3. Except as noted above, the sampling, curing, and testing of cylinders shall be in accordance with ASTM C172 (sampling), C31 (curing), and C39 (testing).
 - 4. The Architect shall receive a report on the cylinder break results.
- B. Re-testing of rejected materials and installed work shall be done at the Contractor's expense.

- C. Test reports shall be furnished to the Contractor, the Architect, and the Owner for all tests required. Test reports shall be furnished within seventy-two (72) hours of the pour.
- D. The Contractor shall notify the Architect and the independent testing laboratory twenty-four (24) hours in advance of any pour.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland cement: ANSI/ASTM C150, Type I, unless otherwise acceptable to the Architect. Use one (1) brand of cement throughout the project, unless otherwise is acceptable to the Architect.
- B. Fine and coarse aggregates: ANSI/ASTM C33. Maximum size shall be 1" river rock.
- C. All mixing water shall be clean and free from deleterious amounts of acids, alkalies, or organic materials.
- D. Air-entraining admixture: ANSI/ASTM C260.
- E. Water-reducing admixture: ANSI/ASTM C494, Type A, and contain not more than 1% chloride ions.
- F. Water-reducing, accelerator admixture: ASTM C494, Type C or E. Subject to compliance with requirements, provide one (1) of the following:
 - 1. Accelguard 80 by Euclid Chemical Co.
 - 2. Pozzolith 122-HE by Master Builders.
 - 3. Polarset by W.R. Grace.
 - 4. Sikacrete by Sika Chemical Co.
- G. Fly ash: ASTM C618.
- H. Where required, expansion joint material shall be ½" thick asphalt-impregnated pre-molded fiber conforming to the latest revised Standard Specification for Preformed Expansion Joint Filler for Concrete, ASTM D1752.
- I. Curing compound shall conform to the latest revised Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete, ASTM C309. Take special care to insure that curing compound is compatible with final floor finish. **Some finish floors prohibit the use of curing compound; the Contractor shall verify.**
- J. Non-shrink grout: CRD-C 588, factory pre-mixed grout. Type D – Non-metallic:
 - 1. Masterflow 713 by Master Builders.
 - 2. SonogROUT by Sonneborn-Contech.

3. Euco-NS by Euclid Chemical Co.
 4. Five Star Grout by U.S. Grout Co.
 5. Duragrout by L & M Cost. Chemical Co.
- K. Curing, hardener, sealer: Acrylic base compound equal to W.R. Meadows' VOCOMP-25 (Transparent). Verify with the Architect. Use this material for curing and sealing exposed finish concrete floors as noted in the Finish Schedule as "Sealed Concrete." **Some finish floors must be water-cured and chemical hardeners and sealers are prohibited. Refer to Division 9.**
- L. Absorptive cover: Burlap cloth made from jute of kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.
- M. Moisture-retaining cover: Comply with ANSI/ASTM C171.
- N. Liquid membrane-forming curing compound: Liquid type membrane-forming curing compound complying with ANSI/ASTM C309, Type 1, Class A unless other type is acceptable to the Architect. **Some finish floors must be water-cured and chemical hardeners and sealers are prohibited. Refer to Division 9.**
- O. Bonding compound: Polyvinyl acetate, rewettable type.
- P. Epoxy adhesive: 100% solids, two-component material suitable for use on dry or damp surfaces. Subject to compliance with requirements, provide one (1) of the following:
1. Thiopoxy by W.R. Grace.
 2. Sikadur Hi-Mod by Sika Chemical Co.
 3. Euco Epoxy by Euclid Chemical Co.

2.02 PROPORTIONING AND DESIGN OF MIXES

- A. The laboratory shall prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
- B. Adjustment to concrete mixes: Mix design adjustments may be requested by the Contractor – when characteristics of materials, job conditions, weather, test results, or other circumstances warrant – at no additional cost to the Owner and as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Architect before using in the work.
- C. Admixtures:
1. With the Architect's approval, the Contractor may use accelerating admixtures in concrete slabs placed at ambient temperatures below 50° F.
 2. With the Architect's approval, the Contractor may use air-entraining admixtures in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at the manufacturer's prescribed rate.

3. With the Architect's approval, the Contractor may use admixtures for water-reducing and set-control in strict compliance with the manufacturer's directions.
- D. Slump limits: Proportion and design mixes are to result in concrete slump at the point of placement as follows:
1. Ramps and sloping surfaces: Not more than 3".
 2. Reinforced foundation systems: Not less than 1" and not more than 3".
 3. Other concrete: Not less than 2" and not more than 5".
- E. If fly ash is used, not more than 10% of the cement may be replaced by fly ash. Fly ash may not be used in concrete slabs to receive a float, trowel, or non-slip finish.
- F. Calcium chloride shall not be used.
- G. Cement factor: Minimum 5½ sacks per cubic yard of concrete.
- H. All concrete for foundations and building slabs shall have a minimum 28-day compressive strength of 3,500 psi.
- I. All concrete for paving shall have a minimum 28-day compressive strength of 3,500 psi, and 5% entrained air is required.
- J. Concrete shall be manufactured and delivered in accordance with the latest revised Standard Specification for Ready-Mixed Concrete, ASTM C94.
- K. Accelerating admixtures may be used in cold weather only when approved by the Architect. Use of admixtures will not relax cold weather placement requirements.

2.03 CONCRETE MIXES

- A. Ready-mix concrete: Comply with the requirements of ANSI/ASTM C94 and as herein specified.
1. Proportions shall be made by weight and shall be uniformly and accurately controlled and inspected by the testing laboratory employed by the Contractor.
 2. During hot weather or under conditions contributing to rapid setting of concrete, a shorter mixing time than that specified in ANSI/ASTM C94 may be required.
 3. When the air temperature is between 85° F and 90° F, reduce the mixing and delivery time from ninety (90) minutes to seventy-five (75) minutes; when the air temperature is above 90° F, reduce the mixing and delivery time to sixty (60) minutes.
 4. In cold weather, concrete operations may be assisted by using hot water or by preheating the aggregates prior to mixing operations or by a combination thereof to ensure that concrete is maintained at a temperature of 40° F or more.

2.04 ACCESSORIES

- A. Sealant at expansion joints and open controlled joints: Sonolastic Paving Joint Sealant (SL-1) by Sonneborn.
- B. Moisture barrier:
 - 1. Provide a moisture barrier over prepared base material.
 - 2. Use only materials which are resistant to decay when treated in accordance with ANSI\ASTM E1745 Class A as follows:
 - a. Polyethylene sheet not less than 15 mils thick. A moisture barrier is required underneath all building slabs. Lap all seams 12" and tape all penetrations and seams.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed and held securely and will not cause hardship in placing concrete.
- B. Verify that all electrical conduit and piping that is to be installed underneath concrete is correctly and accurately placed and will not cause hardship in placing concrete.

3.02 LAY-OUT

- A. The Contractor shall lay out all concrete work from the drawings and shall furnish, set, and maintain all necessary stakes, benchmarks, and batter boards for determining clearly all required lines and levels.
- B. The Contractor shall be responsible for his lay-out and shall correct any errors and verify measurements and elevations.
- C. Dimensions for mechanical unit pads and freezer/cooler pads as shown on the drawings are based on sizes and clearance requirements of the units specified. Verify the actual unit sizes and clearances with the actual mechanical systems.

3.03 PREPARATION

- A. Prepare previously placed concrete by cleaning with a steel brush and applying a bonding agent. Apply the bonding agent in accordance with the manufacturer's instructions.
- B. All brackets, anchors, bolts, inserts, straps, and all other items to be installed in concrete shall be built in as the concrete work is executed.

3.04 PREPARATION OF FORM SURFACES

- A. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

- B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with the manufacturer's instruction.
- C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained formwork is not acceptable.
- D. See also the structural drawings and notes.

3.05 CONCRETE PLACEMENT

- A. Notify the Architect and the independent testing laboratory twenty-four (24) hours in advance of concrete pour.
- B. Ready-mixed concrete hauled in truck mixers or truck agitators shall be deposited in place within ninety (90) minutes from the time water is added to the mix. See 2.03 A.3.
- C. Before placing concrete, free-standing water, snow, ice, or other foreign materials shall be removed from the subgrade. All forms shall be thoroughly cleaned, secured in position, and coated with a form-release agent.
- D. Maintain concrete cover around reinforcing as follows:

<u>Item</u>	<u>Coverage</u>
Walls (exposed to weather or backfill)	2 inch
Footings and concrete formed against the earth	3 inch
Slabs on fill	3 inch

- E. Place concrete continuously between predetermined construction and control joints.
- F. Pavement shall be pitched to perimeter areas to remove water. Slabs of buildings shall be pitched to floor drains.
- G. Sidewalks adjacent to buildings shall be pitched to drain water away from the buildings.
- H. Separate exterior slabs on fill from vertical surfaces with expansion joint filler. Extend joint filler from the bottom of the slab to within ½" of the finished slab surface. Seal all expansion joints with sealant.
- I. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify the Architect upon discovery.
- J. Preplacement inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

- K. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- L. General:
 - 1. Comply with ACI 304 and as herein specified.
 - 2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- M. Placing concrete in forms:
 - 1. Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while the preceding layer is still plastic to avoid cold joints.
 - 2. Consolidate the placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI-recommended practices.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer and at least 6" into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- N. Placing concrete slabs:
 - 1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
 - 2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth surfaces free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
 - 4. Maintain reinforcing in proper position during concrete placement operations.
- O. Cold weather placing:

1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures in compliance with ACI 306 and as herein specified
 2. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators.
- P. Hot weather placing:
1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 except that the temperature of concrete at the time of placement shall be less than 90° F.
 2. Wet forms thoroughly before placing concrete.

3.06 FINISH OF FORMED SURFACES

- A. Rough form finish: For formed concrete surfaces that are not exposed to view.
- B. Smooth form finish: For formed concrete surfaces that are exposed to view or that are to be covered with a coating material applied directly to concrete, such as waterproofing, dampproofing, painting, or other similar system. This is a cast concrete surface obtained with selected form-facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas; fins or other projections are to be completely removed and smoothed.
- C. Smooth rubbed finish: Provide a smooth rubbed finish to scheduled concrete surfaces which have received smooth form finish treatment not later than one (1) day after form removal. **Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.**
- D. Finish floors of interior slabs with a trowel finish unless otherwise designated. Pitch to floor drains ¼" per foot nominal.
- E. Paving and sidewalks shall have a light broom finish.

3.07 MONOLITHIC SLAB FINISHES

- A. Scratch finish: Apply a scratch finish to monolithic slab surfaces that are to receive mortar setting beds for tile and other bonded, applied, cementitious material.
- B. Float finish:
 1. Apply a float finish to monolithic slab surfaces that are to receive a trowel finish and other finishes as hereinafter specified.
 2. Begin floating when surface water has disappeared, when concrete has stiffened sufficiently to permit the operation of power-driven floats, or both. Consolidate the surface with power-driven floats or by hand-floating if the area is small or inaccessible to power units.

3. Check and level the surface plane to a tolerance not exceeding $\frac{1}{4}$ " in 10' when tested with a 10' straight edge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

C. Trowel finish:

1. Apply a trowel finish to monolithic slab surfaces that are to be exposed to view and to slab surfaces that are to be covered with resilient flooring, paint, carpet, or other thin-film finish coating system.
2. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
3. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding $\frac{1}{8}$ " in 10' when tested with a 10' straight edge.
4. Grind smooth surface defects which would telegraph through the applied floor covering system.

D. Liquid curing, hardener, sealer:

1. Liquid curing compound may be used if compatible with final floor finish. **The Contractor shall verify final floor finish requirements.**
2. Apply cure coats to a sound and properly finished surface when workman can no longer damage the floor by walking. Apply at rate of 200-400 s.f. per gallon. Apply second cure coat as recommended by the manufacturer.
3. Apply dustproofing and seal coat in accordance with the Room Finish Schedule immediately before occupancy of the building. Do not apply until all grease and foreign material has been removed from slab as recommended by the manufacturer.
4. Apply all coats to form a continuous, uniform film by spray, soft-bristle pushbroom, long-nap roller, or lambswool applicator. Apply tape along edges to protect walls.

3.08 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seven (7) days.

3. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing methods: Perform curing of concrete by moisture curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof as herein specified.
1. Liquid curing will be allowed so long as the liquid curing compound is compatible with the final floor finish.
- C. Provide moisture curing by following methods:
- a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping continuously wet. Place absorptive cover to provide cover of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
2. Provide moisture-retaining cover curing as follows:
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive.
 - b. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- D. Curing formed surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moisture curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by the methods specified above as applicable.

3.09 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-in: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete the work.
- B. All areas under concrete floor slab shall have vapor barrier with joints lapped at least 12". Take care to lay material smooth and even and to avoid tearing or puncturing. Seal tightly at all expansion joints and spaces around pipes, conduits, and other penetrations.

3.10 CONCRETE CONTROL JOINTS AT PAVING, SLABS, AND SIDEWALKS

- A. Saw-cut or form control joints as soon as possible without raveling the new concrete. Control joints shall extend through curbs adjacent to concrete paving. Review control joint layout with the Architect prior to initiating the work.
- B. Saw and install masonite strips, pre-molded plastic joints, or tool paving control joints to a minimum depth of one-fourth the slab thickness. Saw control joints 10'-0" c.c. (maximum spacing) in each direction at concrete paving. Zip-strips or ¼" masonite may be used in place of sawed joints; take special care to ensure that control joints are straight.
- C. Control joints at sidewalks shall be 1" deep and ¼" wide. Tool ¼" radius on all exposed edges. Space joints (8'-0" maximum) evenly.
- D. All joints shall be completed before uncontrolled shrinkage cracking occurs. This may be as soon as four (4) hours after placement but shall not occur later than eight (8) hours after placement.

3.11 EXPANSION JOINTS AT CONCRETE CURBS

- A. All concrete curbs shall have expansion joints at 50'-0" c.c. (minimum spacing). Discontinue reinforcing at expansion joints.

3.12 SEALANT AT EXPANSION JOINTS AND OPEN CONTROL JOINTS

- A. Take special care to ensure that joints are clean and free of foreign matter.
- B. Install sealant in strict accordance with the manufacturer's written instructions.

3.13 COORDINATION

- A. Refer to the mechanical and electrical plans and Divisions 21, 22, 23, 26, 27, and 28 of these specifications for coordination of chase sizes. Take special care to coordinate holes in slabs with mechanical and electrical space requirements.

END OF SECTION

SECTION 03 62 00
NON-SHRINK GROUTING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Shrink-resistant grout.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Non-shrink grout: CRD-C 588, factory pre-mixed grout. Type D, non-metallic:
 - 1. MasterFlow 713 by Master Builders.
 - 2. SonogROUT by Sonneborn-Contech.
 - 3. Euco NS by Euclid Chemical Company.
 - 4. DuragROUT by L & M Cost. Chemical Co.
- B. Sealant at expansion joints and open control joints:
 - 1. Sonolastic Paving Joint Sealant (SL-1) by Sonneborn at all sealed concrete slabs.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that existing conditions are satisfactory and are ready to receive grout or sealant.
- B. Take special care to ensure that joints are clean and free of foreign matter.

3.02 INSTALLATION

- A. Filling-in: Fill in holes and openings left in structures for passage of work by other trades.
- B. Install sealant in strict accordance with the manufacturer's written instructions.
- C. Install in floor control joints.

3.03 COORDINATION

- A. Refer to the mechanical and electrical plans and specifications for coordination of chase sizes.

END OF SECTION

SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Mortar and grout for masonry.

1.02 RELATED WORK

- A. Section 04 05 19 – Masonry Anchorage and Reinforcing
- B. Section 04 05 23 – Masonry Accessories
- C. Section 04 21 13 – Brick Masonry
- D. Section 04 22 00 – Concrete Unit Masonry
- E. Section 08 11 13 – Hollow Metal Doors and Frames

1.03 REFERENCES

- A. ASTM C5 – Quicklime for Structural Purposes.
- B. ASTM C91 – Masonry Cement.
- C. ASTM C94 – Ready-Mixed Concrete.
- D. ASTM C144 – Aggregate for Masonry Mortar.
- E. ASTM C150 – Portland Cement.
- F. ASTM C207 – Hydrated Lime for Masonry Purposes.
- G. ASTM C270 – Mortar for Unit Masonry.
- H. ASTM C780 – Test Methods

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and the surrounding air temperature to a minimum of 50° F prior to, during, and for forty-eight (48) hours after completion of masonry work.
- B. Comply with the International Masonry All Weather Council's Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Premix mortar: ASTM C387, using gray cement, normal strength.

- B. Mortar color: As selected by the Owner and the Architect for brick, standard gray at painted CMU walls.
- C. Grout aggregate: ASTM C404.
- D. Water: Clean and potable.

2.02 MORTAR MIXES

- A. Mortar for load-bearing walls and reinforced masonry, non-load-bearing walls, veneers, and partitions: ASTM C270, Type S, using Property Method.
- B. Mortar for below grade: ASTM C270, Type M, using Property Method.

2.03 MORTAR MIXING

- A. In accordance with ASTM C270, thoroughly mix mortar ingredients as needed for immediate use.
- B. Add color and admixtures in accordance with the manufacturer's specifications.
- C. Anti-freeze additives are not allowed.

2.04 GROUT MIXES

- A. Minimum 2,500 psi strength at twenty-eight (28) days; 8-10" slump; premixed type mixed in accordance with ASTM C476.
- B. Anti-freeze additives are not allowed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install mortar and grout in accordance with Section 04 21 13.
- B. Work grout into cores and cavities to eliminate voids. All joints, head, bed, and collar shall be completely filled. Exception: weep holes.
- C. Do not displace reinforcing steel when placing grout.
- D. Mortar joints at face brick are to be tooled concave when thumbprint hard.
- E. Mortar joints at exposed CMU are to be tooled concave when thumbprint hard.
- F. Hollow metal frames shall be slushed full with grout where installed in masonry walls.
- G. Keep wall cavities free of mortar droppings and bridges.

END OF SECTION

SECTION 04 05 19
MASONRY ANCHORAGE AND REINFORCING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Masonry reinforcement, anchors, and accessories.

1.02 RELATED WORK

- A. Section 01 33 00 – Submittal Procedures
- B. Section 04 05 13 – Masonry Mortaring
- C. Section 04 21 13 – Brick Masonry
- D. Section 04 22 00 – Concrete Unit Masonry
- E. Section 05 50 00 – Metal Fabrications
- F. Section 07 27 26 – Fluid-Applied Membrane Air Barriers

1.03 REFERENCES

- A. Brick Industry of America (BIA).
- B. National Concrete Masonry Association.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Provide a mock-up area on an existing wall condition for review.

PART 2 - PRODUCTS

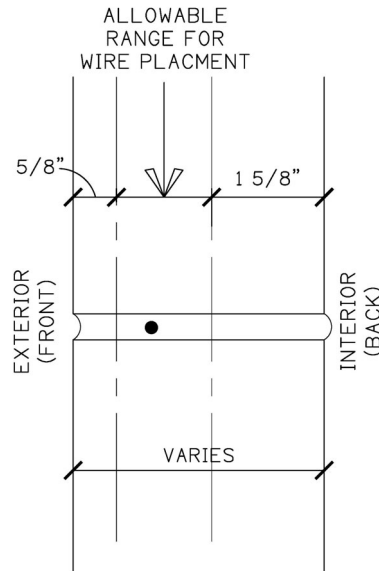
2.01 REINFORCEMENT AND ANCHORAGE

- A. Brick, cast stone, and cavity walls with metal stud back-up.
 - 1. Veneer anchor system:
 - a. Equal to Hohmann & Barnard
 - 1) Anchor plate: HB-213-2X S.I.S., 12 gauge, hot dipped galvanized.
 - 2) Pintle: Compressed Leg 2X - Hook, 12 gauge, hot dipped galvanized.

- 3) Seismic wire: Continuous 9 gauge, hot dipped galvanized, joint reinforcement wire.
 - b. Coating: ASTM A153, Class B hot dipped galvanized, 1.50 oz. psf (all parts)
 - c. Anchor plates are to accommodate 2" thick rigid insulation.
 - d. Plate pintle sized to accommodate 2" air space. Plate shall accept 9 gauge continuous wire, which shall be installed in each reinforced joint at 16" o.c. vertically. The anchor system shall be sized so that continuous wire shall be installed a minimum of 1 $\frac{5}{8}$ " from the interior (back) side into the masonry unit and shall allow a minimum of $\frac{5}{8}$ " coverage at the exterior (front) side of the masonry unit (refer to Continuous Seismic Wire Placement, 2.02 of this section).
 - e. Attach to stud back up with two (2) #12-14 304 stainless steel screws.
2. Coordinate with work performed under Section 07 27 26. Spray all installed back plates with two (2) coats of fluid-applied membrane air barrier. Any back plates installed after the installation of the fluid-applied membrane air barrier shall be sealed over with liquid flashing as described in Section 07 27 26.
 3. General joint reinforcement: 9 gauge hot dipped galvanized wire, for use as concrete masonry wall reinforcing as manufactured by Hohmann & Barnard, Inc., Wire-Bond, Southern Construction Products, Inc., or approved equal, 16" o.c. each way.
- B. Interior CMU walls:
1. Equal to #120 Truss-Mesh Reinforcement by Hohmann & Barnard, Inc.
 2. Coating : ASTM A153, Class B hot dipped galvanized, 1.50 oz. psf.
 3. Wire size: Standard weight, 9 gauge side rods x 9 gauge cross rods.
 4. Sized for 8" and 12" nominal CMU.
 5. Install 16" o.c. vertically.
- C. Weld-on ties: As detailed; refer to structural and architectural details.

2.02 CONTINUOUS SEISMIC WIRE

- A. Continuous seismic wire placement: The continuous wire shall be installed a minimum of 1 $\frac{5}{8}$ " from the interior (back) side into the masonry unit and shall allow a minimum of $\frac{5}{8}$ " coverage at the exterior (front) side of the masonry unit. Refer to the figure below.



2.03 THROUGH-WALL FLASHING

- A. Equal to Cop-R-Cote, by Advanced Building Products, Inc.
- B. Type: Three (3) layers, flexible flashing consisting of a copper sheet coated on both sides with an elastic asphalt compound.
- C. Characteristics: Waterproof, flexible at extreme temperatures, high tensile strength, resistant to mortar acid and alkali action, self-sealing at punctures, and allowing minimum thermal cold flow through the structure.
- D. Copper sheet: Full, single copper sheet weighing 5 oz. copper per s.f. and complying with ASTM B370.
- E. Coating: Plasticized asphalt compound weighing 6 oz. per s.f. minimum.
- F. Roll width: 36".
- G. Utilize pre-manufactured interior corners, exterior corners, and end dams.
- H. Lap seams and seal seams with mastic. Mastic shall be a high-grade, asphalt-based cement used in bonding asphalt-coated flashing to construction surfaces. Mastic is to provide a strong, flexible waterproof barrier with adhesion allowing for expansion and contraction caused by temperature fluctuation or building movement.
- I. Follow the manufacturer's installation recommendations.
- J. Coordinate with work performed under Section 07 27 26 in regard to liquid flashing at termination bars, laps, and seams.

2.04 OTHER ACCESSORIES

- A. Weeps: Full head joints are required. Provide and install Hohmann & Bernard QV-Quadro-Vent or equal.
 - 1. Honeycomb design allowing passage of moisture from cavity to the exterior while restricting ingress of insects and other debris.
 - 2. Allowing passage of moisture up to its 2½" height.
 - 3. Suitable for top wall venting.
 - 4. Polypropylene construction.
 - 5. Color: Clear.
 - 6. Size: Standard (¾" thick x 3¾" wide x 2½" tall).
- B. Control joints: Equal to VS Series PVC Control Joint by Hohmann & Barnard, Series 600 by Greenstreak, or 9101 Regular by Southern Construction Products, Inc.
- C. Mortar net: Equal to mortar net for cavity walls, a high density polyethylene drainage system. 2" thick x 10" high. Install continuously at the base of all exterior walls and over all doors, windows, and openings.
- D. Through-wall flashing mastic: Fibrated, trowel grade mastic consisting of asphalt, mineral stabilizers, and interfibe complying with ASTM D2822, Type 1; Cop-R-Tite Flashing Mastic as manufactured by Advanced Building Products, Inc., or equal.
- E. Termination bars equal to Sandell's ⅛" x 1" stainless steel with pre-punched ¼" diameter holes at 8" o.c.
- F. Stainless steel sub-sill pans, end dams, drip edge, and thru-wall flashing at areas indicated on the drawings: Forged from 20 gauge stainless steel with welded and ground joints. Workmanship shall be smooth with no burrs or protrusions which could penetrate other materials.
- G. Prefinished metal flashing at door and window jambs.
 - 1. 24 gauge.
 - 2. Kynar 500 finish.
 - 3. Color to match door/window frames.
 - 4. Configurations as shown on the drawings.
 - 5. Attached to treated wood blocking with required corrosion-resistant fasteners compatible with metal flashing.
 - 6. Seal to treated wood blocking with liquid flashing as described in the drawings and in Section 07 27 26. Cover all fasteners for an air-tight barrier.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Schedule a pre-installation conference with the Architect and all trades.

3.02 REINFORCEMENT AND ANCHORAGE

- A. Install joint reinforcement at 16" o.c. each way.
- B. Place masonry joint reinforcement in the first and second horizontal joints above and below openings. Extend 16" minimum each side of opening.
- C. Place joint reinforcement continuous in the first joint below the top of walls.
- D. Lap joint reinforcement ends minimum 6". Extend 16" minimum each side of opening.
- E. Place reinforcing bars supported and secured against displacement. Maintain position within ½" of true dimension.
- F. Reinforce corners and intersections with pre-formed units of reinforcement at 16" o.c.
- G. Discontinue reinforcement and anchorage at expansion joints and control joints.

3.03 CONCRETE FILLING AND GROUT (NEW CONSTRUCTION)

- A. Reinforce bond beam, pilasters, and cells at doors, windows, and openings.
- B. Support and secure reinforcing bars. Maintain within ½" of dimensioned position.
- C. Do not displace reinforcing. Work into cores and cavities to eliminate voids.
- D. At bearing locations, fill side cores with concrete for a minimum 12" each side.
- E. Fill cores at reinforced cells at exterior walls.

3.04 THROUGH-WALL FLASHING

- A. Coordinate installation of flashings with erection of masonry walls to ensure material is provided in timely manner for embedment in mortar joints.
- B. Coordinate with work performed under Section 07 27 26 in regard to liquid flashing at termination bars, laps, and seams.
- C. Inspection: Verify that masonry surfaces to receive through-wall flashings are smooth, free of loose materials, and properly sloped to provide drainage.
- D. Verify that adequate weep holes and mortar deflection devices and through-wall flashing drip edges are being installed to provide proper drainage at flashing locations.
- E. Install flashings in accordance with the drawings, approved shop drawings, and the manufacturer's recommended installation instructions.

1. Use recommended adhesive and sealer.
2. Form end dams at all locations to provide positive drainage to weep holes.
- F. Install copper flashings at all foundation sills, base of exterior walls, window and door sills and heads, through-wall conditions, and other locations as detailed on the drawings.
- G. Lap joints: Coat contacting surfaces with mastic and lap 6" inches minimum. Roll with a hand roller until mastic bead appears at the edges.
- H. After installation of flashings (and completion of masonry assemblies), inspect the work.
 1. Verify that flashings have been properly installed at all required locations to prevent water penetration.
 2. Verify that weep holes have been provided to ensure proper drainage to the exterior.
- I. Extend flashing all the way through masonry course. Terminate at exterior with a visible drip edge.
- J. Trim exposed flashings flush with masonry surfaces after installation has been reviewed by the Architect.

3.05 CONTROL AND EXPANSION JOINTS

- A. Install preformed control joint devices at all interior masonry walls not to exceed 32'-0" o.c. Sealant and backer rod are required.
- B. Locate control joints not to exceed 20'-0" o.c. or as indicated on the exterior elevation drawings in exterior walls through both block and brick. Sealant and backer rod are required.

END OF SECTION

SECTION 04 21 13
BRICK MASONRY

PART 1 - GENERAL

1.01 FURNISH AND INSTALL THE FOLLOWING:

- A. Face brick.

1.02 RELATED WORK

- A. Section 01 21 00 – Allowances
- B. Section 04 05 13 – Masonry Mortaring
- C. Section 04 05 19 – Masonry Anchorage and Reinforcing
- D. Section 04 22 00 – Concrete Unit Masonry
- E. Section 05 50 00 – Metal Fabrications

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and the surrounding air temperature to a minimum of 50° F prior to, during, and for forty-eight (48) hours after completion of the masonry work. Comply with the International Masonry Industry All Weather Council's Recommended Practices and Guide Specifications for Cold Weather.

1.04 REFERENCES

- A. Brick Industry Association (BIA): www.bia.org.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Provide a section of the complete wall system using all materials for the Architect's approval.

PART 2 - PRODUCTS

2.01 FACE BRICK

- A. Refer to Section 01 21 00 – Allowances.

2.02 MORTAR

- A. Refer to Section 04 05 13 – Masonry Mortaring.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that items provided by other sections of work are properly sized and located. Take special care to coordinate masonry work with the requirements of Divisions 21, 22, 23, 25, 26, 27, and 28 of these specifications.
- B. Establish lines, levels, and coursing. Protect from disturbance.
- C. Provide temporary bracing during erection of masonry work. Maintain in place until the building structure provides permanent bracing.
- D. Review locations where waterproofing is required.

3.02 COURSING

- A. Place masonry to the lines and levels indicated.
- B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
- C. Lay brick masonry units in running bond. Form tooled concave mortar joints.
- D. Review control joint locations and configurations with the Architect prior to initiating the work.

3.03 PLACING AND BONDING

- A. Lay masonry in a full bed of mortar, properly jointed with other work. All joints, head, bed, and collar shall be completely filled. Buttering the corners of joints and deep or excessive furrowing of mortar joints are not permitted.
- B. Fully bond intersections and external and internal corners.
- C. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- D. Remove excess mortar.
- E. Perform jobsite cutting with the proper tools to provide straight, unchipped edges. Take care to prevent breaking masonry unit corners or edges.
- F. Weep holes (full head joint) are required at the bottom of all masonry walls, above all flashings, shelf, and angles, and lintels at 24" o.c. horizontally.

3.04 TOLERANCES

- A. Variation from unit to adjacent unit: 3/32" maximum.
- B. Variation from the plane of the wall: 1/4" in 10'; 1/2" in 20' or more.
- C. Variation from plumb: 1/4" per story noncumulative.

- D. Variation from level coursing: $\frac{1}{8}$ " in 3'; $\frac{1}{4}$ " in 10'.
- E. Variation of joint thickness: $\frac{1}{8}$ " in 3'.
- F. Maximum variation from cross sectional thickness of walls: Plus or minus $\frac{1}{4}$ ".

3.05 REINFORCEMENT AND ANCHORAGE

- A. See Section 04 05 19 – Masonry Anchorage and Reinforcing.

3.06 CUTTING AND FITTING

- A. Cut and fit for pipes, conduit, and sleeves. Cooperate with other sections of work to provide correct size, shape, and location. Take special care to coordinate the work of this section with the requirements of Divisions 21, 22, 23, 25, 26, 27, and 28 of these specifications.
- B. Obtain approval prior to cutting or fitting any area not indicated or where the appearance or strength of masonry work may be impaired.

3.07 CLEANING

- A. Clean soiled surfaces with a non-acidic solution which will not harm masonry or adjacent materials. Consult the masonry manufacturer for acceptable cleaners. Consult the painting contractor and the manufacturer of paint, primer, and elastomeric coatings to ensure that cleaning solutions are compatible with finishes.
- B. Use non-metallic tools in cleaning operations.

3.08 PROTECTION

- A. Provide protection without damaging completed work.
- B. At day's end, cover unfinished walls to prevent moisture infiltration.
- C. Keep masonry units covered and dry to prevent moisture infiltration during storage and construction.

3.09 LINTELS

- A. Install steel lintels over openings where brick veneer is scheduled.
- B. Provide a minimum of 8" bearing on each side of opening.

3.10 CONTROL AND EXPANSION JOINTS

- A. See Section 04 05 19 – Masonry Anchorage and Reinforcing.

END OF SECTION

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Concrete masonry units.

1.02 RELATED WORK

- A. Section 04 05 13 – Masonry Mortaring
- B. Section 04 05 19 – Masonry Anchorage and Reinforcing
- C. Section 04 21 13 – Brick Masonry
- D. Section 05 50 00 – Metal Fabrications

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and the surrounding air temperature to a minimum of 50° F prior to, during, and for forty-eight (48) hours after completion of masonry work. Comply with the International Masonry Industry All Weather Council's Recommended Practices and Guide Specifications for Cold Weather.
- B. ASTM C90, latest edition.

1.04 REFERENCES

- A. National Concrete Masonry Association.

1.05 SUBMITTALS

- A. Test panels with project CMU are required for approval of the Architect and the Owner.
- B. Provide an in-place sample of the complete wall system using all materials for the Architect's approval.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete masonry units shall be in accordance with the requirements specified herein and the current issues of the following applicable specifications and standards:
 - 1. Load-bearing concrete masonry units:
 - a. ASTM C90, latest edition.
 - b. Minimum compressive strength based on net cross-sectional area:

- 1) Minimum 1,700 psi for individual units.
 - 2) Minimum 1,900 psi for average of three (3) units.
 2. Provide fire-rated units as shown on drawings in accordance with the requirements of the 2018 International Building Code.
- 2.02 CONCRETE MASONRY LINTELS, BOND BEAMS, AND EXTERIOR WALLS
- A. Lintels: Refer to Sheet S1.1.
 - B. Bond beams: Refer to Sheet S1.1.
 - C. Concrete: 3,500 psi at twenty-eight (28) days; 8-10" slump.
 - D. Grout: 2,500 psi at twenty-eight (28) days; 8-10" slump.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that items provided by other sections of work are properly sized and located. Take special care to coordinate masonry work with the requirements of Divisions 21, 22, 23, 25, 26, 27, and 28 of these specifications.
- B. Establish lines, levels, and coursing. Protect from disturbance.
- C. Provide temporary bracing during erection of masonry work. Maintain in place until the building structure provides permanent bracing.
- D. Review locations where waterproofing is required.

3.02 COURSING

- A. Place masonry to the lines and levels indicated.
- B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
- C. Lay concrete masonry units in running bond. Course one (1) block unit and one (1) mortar joint to equal 8". Form tooled concave mortar joints.
- D. Review control joint locations and configurations with the Architect prior to initiating the work.

3.03 PLACING AND BONDING

- A. Lay masonry in a full bed of mortar, properly jointed with other work. All joints, head, bed, and collar shall be completely filled. Buttering the corners of joints and deep or excessive furrowing of mortar joints are not permitted.

- B. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- C. Remove excess mortar.
- D. Perform jobsite cutting with the proper tools to provide straight, unchipped edges. Take care to prevent breaking masonry unit corners or edges.
- E. Weep holes (full head joint) are required at the bottom of all masonry walls, above all flashings, shelf, and angles, and lintels at 24" o.c. horizontally.

3.04 TOLERANCES

- A. Variation from unit to adjacent unit: $\frac{3}{32}$ " maximum.
- B. Variation from the plane of the wall: $\frac{1}{4}$ " in 10' and $\frac{1}{2}$ " in 20' or more.
- C. Variation from plumb: $\frac{1}{4}$ " per story noncumulative.
- D. Variation from level coursing: $\frac{1}{8}$ " in 3'; $\frac{1}{4}$ " in 10'.
- E. Variation of joint thickness: $\frac{1}{8}$ " in 3'.
- F. Maximum variation from cross sectional thickness of walls: Plus or minus $\frac{1}{4}$ ".

3.05 REINFORCEMENT AND ANCHORAGE

- A. See Section 04 05 19 – Masonry Anchorage and Reinforcing.

3.06 CUTTING AND FITTING

- A. Cut and fit for pipes, conduit, and sleeves. Cooperate with other sections of work to provide correct size, shape, and location. Take special care to coordinate the work of this section with the requirements of Divisions 21, 22, 23, 25, 26, 27, and 28 of these specifications.
- B. Obtain approval prior to cutting or fitting any area not indicated or where the appearance or strength of masonry work may be impaired.

3.07 CLEANING

- A. Clean soiled surfaces with a non-acidic solution which will not harm masonry or adjacent materials. Consult the masonry manufacturer for acceptable cleaners. Consult the painting contractor and the manufacturer of paint, primer, and elastomeric coatings to ensure that cleaning solutions are compatible with finishes.
- B. Use non-metallic tools in cleaning operations.

3.08 PROTECTION

- A. Provide protection without damaging completed work.

- B. At day's end, cover unfinished walls to prevent moisture infiltration.
- C. Keep masonry units covered and dry to prevent moisture infiltration during storage and construction.

3.09 LINTELS

- A. Install concrete masonry lintels over openings where steel lintels are not required.
- B. Provide a minimum of 8" bearing on each side of opening.

3.10 CONTROL AND EXPANSION JOINTS

- A. See Section 04 05 19- Masonry Anchorage and Reinforcing.

END OF SECTION

SECTION 05 31 10
STEEL FLOOR DECKING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Steel deck and accessories.

1.02 REFERENCES

- A. AISI – Specification for the Design of Cold-Formed Steel Structural Members.
- B. ASTM A36 – Structural Steel.
- C. ASTM A525 – Steel Sheet, Zinc-Coated, Galvanized by Hot-Dip Process.
- D. ASTM A466 – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
- E. ASTM A611 – Steel, Cold-Rolled Sheet, Carbon Structural.
- F. ASW D1.1 – Structural Welding Code.
- G. SDI – Design Manual for Composite Decks, Form Decks, Roof Decks.

1.03 PERFORMANCE REQUIREMENTS

- A. Design metal decking in accordance with SDI's Design Manual for Composite Decks, Form Decks, Roof Decks.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Shop drawings: Indicate decking plan, support locations, projections, openings and reinforcement, pertinent details, and accessories.
- C. Product data: Provide deck profile characteristics and dimensions, structural properties, and finishes.
- D. Manufacturer's installation instructions: Indicate specific installation sequence.

1.05 DELIVERY AND HANDLING

- A. Store and protect products from damage.
- B. Cut plastic wrap to encourage ventilation.
- C. Separate sheets and store decking on dry wood sleepers; slope for positive drainage.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheet metal: ASTM A446, Grade A structural quality, with G90 galvanized coating conforming to ASTM A525.
- B. Bearing plates: ASTM A36 steel.
- C. Welding materials: AWS D1.1.
- D. Touch-up primer: Zinc chromate type.

2.02 FABRICATION

- A. Metal decking: Refer to the structural drawings at the storm shelter.
- B. Metal closure strips, cover plates, and related accessories: 20 gauge galvanized sheet steel; of profile and size as required.
- C. Fasteners: Galvanized hardened steel, steel-tapping.
- D. Weld washers: Mild steel, uncoated, $\frac{3}{4}$ " o.d.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive the work.
- B. Beginning of installation means that the installer accepts the existing conditions.

3.02 INSTALLATION

- A. Erect metal decking in accordance with SDI's Design Manual for Composite Decks, Form Decks, Roof Decks.
- B. Bear decking on supports with 2" minimum bearing. Align and level.
- C. Metal deck shall be installed in strict compliance with the manufacturer's requirements. Attach deck to supporting steel with $\frac{5}{8}$ " puddle welds at 6" c.c. at edges and 12" c.c. elsewhere unless noted otherwise in the sections and details.
- D. Install sheet steel closures and angle flashings to close openings between deck and walls, columns, and openings.
- E. Immediately after welding the deck and other metal components in position, coat welds, burned areas, and damaged surface coating with touch-up primer.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Protective steel bollards.
- B. Angles and braces.

1.02 RELATED WORK

- A. Section 09 91 00 – Painting

1.03 REFERENCES

- A. ASTM A36 and ASTM A992 – Structural Steel.
- B. ASTM A53 – Hot-Dipped, Zinc-Coated Welded and Seamless Steel Pipe.
- C. AWS D1.1 – Structural Welding Code.
- D. FS TT-P-31 – Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.

1.04 SHOP DRAWINGS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Shop drawings:
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 2. Verify field measurements prior to submission of shop drawings to the Architect.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel sections: ASTM A36 and ASTM A992.
- B. Bolts, nuts, and washers: ASTM A325 Bolts.
- C. Welding materials: AWS D1.1; type required for materials being welded.
- D. Primer: FS TT-P-31, red, for shop-application and field touch-up.

2.02 METAL FABRICATIONS

- A. Pipe bollards: 6" diameter steel pipe with a top steel closure plate cap.

PART 3 - FINISH

3.01 PREPARATION

- A. Obtain the Architect's approval prior to site-cutting or making adjustments not scheduled.
- B. Clean and strip site-primed steel items to bare metal where site-welding is scheduled.
- C. Make provisions for erection loads with temporary bracing. Keep work in alignment.
- D. Supply items required to be cased into concrete or embedded in masonry with setting templates to the appropriate sections.

3.02 FABRICATION

- A. Verify dimensions on site prior to shop-fabrication.
- B. Fabricate items with joints tightly fitted and secured.
- C. Fit and shop-assemble in the largest practical sections for delivery to the site.
- D. Grind exposed welds flush and smooth with the adjacent finished surface. Ease exposed edges to a small uniform radius.
- E. Exposed mechanical fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with the design of the structure, except where specifically noted otherwise.
- F. Make exposed joints butt tight, flush, and hairline.
- G. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of the same materials and finish as metal fabrication, except where specifically noted otherwise. Supply sleeves as required for the mounting of newel posts in concrete.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, and free from distortion or defects.
- B. Perform field-welding in accordance with AWS D1.1.
- C. After installation, touch up field-welds and scratched or damaged surfaces with primer.

3.04 FINISH

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact bond with concrete or where field-welding is required.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Plywood sheathing.

1.02 REFERENCES

- A. MIL-L-1914-C Lumber and Plywood, Fire Retardant Treated.
- B. MIL-V-13518C (1) Wood Preservatives: Tetrachlorophenol and Pentachlorophenol, Surface Sealing Compound.
- C. PS 1 – Construction and Industrial Plywood.
- D. PS 20 – American Softwood Lumber Standard.
- E. NFPA – National Design Specification for Wood Construction.
- F. National Forest Products Association National Design Specification for Wood Construction.

1.03 QUALITY ASSURANCE

- A. Rough carpentry lumber: Visible grade stamp, of agency certified by the National Forest Products Association (NFPA).

1.04 JOB CONDITIONS

- A. The Contractor must examine the substrates and supporting structure and the conditions under which the carpentry work is to be installed and must notify the Architect of conditions detrimental to the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer and the Architect. Initiation of installation indicates acceptance of the substrate and existing conditions.

1.05 COORDINATION

- A. Take special care to furnish and install solid wood blocking for the secure mounting of all bathroom and restroom accessories, wall cabinets, clothing hang-rod brackets, and other wall-mounted and ceiling-mounted items.

PART 2 - PRODUCTS

2.01 ROUGH CARPENTRY MATERIALS

- A. Structural light framing: No. 2 grade.
- B. Miscellaneous framing, nailers, and blocking: No. 2 grade.
- C. Wall sheathing: $\frac{3}{4}$ " B-C plywood.
- D. Nails, spikes, and staples: Galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations; size and type to suit application.
- E. Bolts, nuts, washers, lags, pins, and screws: Medium carbon steel sized to suit application; galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations.
- F. Fasteners: Toggle bolt type for anchorage to hollow masonry; expansion shield and lag bolt type for anchorage to steel. Provide and install all anchors, nails, inserts, blocking, grounds, and other carpentry items. Anchor bolts, nuts, and washers and other anchors to concrete and masonry are to be zinc-coated.

PART 3 - EXECUTION

3.01 FURRING AND STRIPPING

- A. Erect wood stripping and nailing members true to lines and levels. Do not deviate from true alignment more than $\frac{1}{4}$ ".
- B. Space members at 16" o.c. or as indicated on the drawings.
- C. Construct members of continuous pieces of the longest possible lengths.

3.02 COORDINATION

- A. Ensure that mechanical and electrical items affecting this section of work are properly placed and complete prior to commencement of installation.

3.03 WOOD BLOCKING

- A. Furnish and install solid wood blocking as required to securely mount base and wall cabinets, and fire extinguisher cabinets.
- B. Furnish and install solid wood blocking as required to securely mount the equipment of Division 21, 22, 23, 26, 27 and Division 28 of these specifications.

END OF SECTION

SECTION 06 16 43
EXTERIOR GYPSUM SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Fiberglass mat-faced, moisture-resistant and mold-resistant gypsum sheathing.

B. Related sections:

1. Section 04 05 19 – Masonry Anchorage and Reinforcing
2. Section 06 10 00 – Rough Carpentry
3. Section 07 21 00 – Thermal Insulation
4. Section 07 27 26 – Fluid-Applied Membrane Air Barriers

1.02 REFERENCES

A. ASTM International:

1. ASTM C473 – Standard Test Methods for Physical Testing of Gypsum Panel Products.
2. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM C1002 – Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
4. ASTM C1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
5. ASTM C1280 – Standard Specification for Application of Gypsum Sheathing.
6. ASTM D3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
7. ASTM D6329 – Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers.
8. ASTM E72 – Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
9. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

- B. Gypsum Association (GA): GA-253 Application of Gypsum Sheathing.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit product data with the manufacturer's specifications and installation instructions for each product specified.

1.04 WARRANTY

- A. Provide products that offer twelve (12) months of coverage against in-place exposure damage (delamination, deterioration, and decay).
- B. Manufacturer's warranty:
 - 1. Five (5) years against manufacturing defects.
 - 2. Ten (10) years against manufacturing defects when used as a substrate in architecturally specified EIFS.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Basis of design: Fiberglass mat-faced gypsum sheathing, 5/8" DensGlass Sheathing by Georgia-Pacific Gypsum LLC.
- B. Equivalent design: Manufacturer with products of equivalent design may include, but are not limited to:
 - 1. National Gypsum Company.
 - 2. USG Corporation.
 - 3. Certain Teed Gypsum, Inc.

2.02 EXTERIOR GYPSUM SHEATHING:

- A. Exterior gypsum sheathing:
 - 1. Thickness: 5/8" thick.
 - 2. Width: 4'.
 - 3. Length: 8'.
 - 4. Edges: Square.
 - 5. Surfacing: Fiberglass mat on face, back, and long edges.

6. Racking strength (ultimate, not design value) (ASTM E72): Not less than 540 lbs. per square foot, dry.
 7. Flexural strength, parallel (ASTM C473): 80 lbf, parallel.
 8. Humidified deflection (ASTM C1177): Not more than $\frac{1}{8}$ ".
 9. Permeance (ASTM E96): 23 perms.
 10. R-Value (ASTM C518): 0.56.
 11. Mold resistance (ASTM D3273): 10, in a test as manufactured.
 12. Microbial resistance (ASTM D6329, GREENGUARD 3-week protocol): Will not support microbial growth.
- B. Exterior gypsum soffit board: Fiberglass mat-faced gypsum backing board, $\frac{5}{8}$ " DensGlass Sheathing by Georgia-Pacific Gypsum, LLC.

2.03 GYPSUM BOARD ACCESSORIES

- A. Provide gypsum board accessories in accordance with GA 216.
- B. Reinforcing tape, joint compound, adhesive, water, fasteners: GA 216.
- C. Corner beads: Metal.
- D. "F" molding: Gordon FD5810 or equal.
- E. "J" molding: Gordon JD-58 or equal.
- F. "R" reveal molding: Gordon RD5812 or equal.
- G. "T" molding: Gordon TD-58 or equal.
- H. Screws: ASTM C1002, equal to Strong-Point 410 Stainless Steel Self-Drilling Flat Head, Passivated and Waxed.

PART 3 - EXECUTION

3.01 EXTERIOR SHEATHING INSTALLATION

- A. Provide exterior sheathing where indicated on the drawings. Install sheathing in accordance with the manufacturer's instructions and the applicable instructions in GA-253 and ASTM C1280.
- B. Install DensGlass Gold Exterior Sheathing with the gold side out.
- C. Use maximum lengths possible to minimize the number of joints.

- D. Metal framing: Attach exterior sheathing to metal framing with self-tapping screws conforming to ASTM C1002 spaced 8" o.c. at the perimeter where there are framing supports and 8" o.c. along intermediate framing in field.
- E. Locate fasteners minimum $\frac{3}{8}$ " from edges and ends of sheathing panels.
- F. Treatment of joints:
 - 1. The exterior face of exterior gypsum sheathing joints shall be taped with FG tape and troweled with Dow Corning 795 building sealant or equal.
 - 2. Joints and fasteners shall be covered using Dow Corning 795 Building Sealant or equal.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Fiberglass batt thermal insulation above ceilings of all heated/cooled spaces.
2. Fiberglass batt thermal insulation at all exterior stud walls.
3. Fiberglass sound batt acoustical insulation at all new interior partition walls.
4. Rigid insulation at all CMU and masonry veneer walls and exterior stud walls.

B. Related sections:

1. Section 04 21 13 – Brick Masonry
2. Section 04 22 00 – Concrete Unit Masonry
3. Section 06 10 00 – Rough Carpentry

1.02 SUBMITTAL REQUIREMENTS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit detailed product information that confirms the thermal performance characteristics of the fiberglass insulation products specified herein.
- C. Insulation must be UL-certified to have a flame spread of 25 or less.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Exterior wall thermal insulation: Fiberglass batt insulation, unfaced, R-19 at all 8" exterior stud walls.
- B. Acoustical insulation: Fiberglass batt sound attenuation blankets at all new interior drywall partitions (3½" and 6" in applicable walls).
- C. Cavity wall insulation: Equal to Dow Styrofoam Cavitymate, 1½" thick. Attach with the manufacturer's approved construction adhesive at stud walls. Verify and coordinate that the adhesive and fluid-applied air weather barrier are compatible. Tape all joints with Dow Styrofoam 3" wide all-purpose tape.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that adjacent materials are dry and are ready to receive insulation.
- B. Verify that mechanical and electrical services within the plenum have been installed and tested.

3.02 INSTALLATION

- A. Install fiberglass insulation in accordance with the manufacturer's instructions.
- B. Fit insulation tight in spaces and tight to the exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- C. Take special care to insure that the plane of insulation is continuous; leave no gaps or voids.
- D. Ensure that dampproofing and rigid insulation are compatible.
- E. Utilize construction adhesive to secure rigid insulation at cavity walls.

END OF SECTION

SECTION 07 26 16
BELOW-GRADE VAPOR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Multi-layer plastic extrusion vapor barrier/retarder beneath all building slabs, footings, and sides of footings.
- B. Note: This product is shown on the drawings as a vapor barrier beneath building slabs.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Plastic extrusion sheet not less than 15 mils thick.
- B. Use a vapor retarder which meets all criteria for Class A per ASTM E1745-97.
- C. Vapor barrier shall have all the following qualities:
 - 1. Maintain permeance of less than 0.01 Perms [grains/(ft² · hr · inHg)] as tested in accordance with mandatory conditioning test per ASTM E1745 Section 7.1 (7.1.1.7.1.5).
 - 2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - 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.
 - b. No manufacturing defects in the product for, at least, the life of the building.
- D. Vapor barrier products:
 - 1. Basis of design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries, LLC, 216 Avenida Fabricante, Suite 101, San Clemente, California 92672; telephone: (877) 464-7834; website: www.stegoindustries.com.
 - 2. Vaporguard by Reef Industries, 9209 Alameda Genoa Road, Houston, Texas 77075; telephone: (800) 231-6074 or (713) 507-4250; website: www.reefindustries.com.

3. Moistop Ultra 15 by Fortifiber Building System Group, 300 Industrial Drive, Fernley, Nevada 89408; telephone: (800) 773-4777; website: <https://www.fortifiber.com/product/moistop-ultra-15/>.
- E. Products shall be equal to Vapor Block 15 by Raven Industries, Griffolyn Division, or Stego 15 Mil A by Stego Industries.
 1. Membrane.
 2. Tape.
 3. Mastic.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install vapor barrier in accordance with 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 terminate it at a point acceptable to the Structural Engineer or 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 the manufacturer's textured tape with a surface that creates a mechanical seal to freshly-placed concrete per the manufacturer's instructions.
 3. Overlap joints 12" and seal with the 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 the manufacturer's instructions.
 6. Avoid the use of stakes driven through the 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

SECTION 07 27 26
FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Materials and installation for fluid-applied membrane to provide an air barrier component and secondary water-resistive barrier/drainage plane for unit masonry and sheathing wall assemblies.
- B. Note: This product is shown on the documents as “LIQUID-APPLIED AIR/WEATHER BARRIER” on exterior gypsum sheathing.
- C. The intent of this section is to ensure that the building envelope is sealed and airtight. Continuous barrier shall be installed over all exterior wall back-up systems that are exposed to the wall cavity. Use accessories as required at dissimilar materials to ensure that the air/weather barrier forms a continuous coating.

1.02 RELATED SECTIONS

- A. Section 03 33 00 – Cast-In-Place Concrete
- B. Section 04 05 19 – Masonry Anchorage and Reinforcing
- C. Section 06 16 43 – Exterior Gypsum Sheathing
- D. Section 07 21 00 – Building Insulation
- E. Section 07 92 00 – Joint Sealants

1.03 REFERENCES

- A. ASTM standards:
 - 1. C297 – Test Method for Tensile Strength of Flat Sandwich Constructions in Flatwise Plane.
 - 2. D522 – Test Methods for Mandrel Bend Test of Attached Organic Coatings.
 - 3. D882 – Test Methods for Tensile Properties of Thin Plastic Sheeting.
 - 4. D2247 – Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity.
 - 5. D3273 – Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
 - 6. E84 – Test Method for Surface Burning Characteristics of Building Materials.
 - 7. E96 – Test Methods for Water Vapor Transmission of Materials.

8. E283 – Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 9. E330 – Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 10. E331 – Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 11. E1233 – Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
 12. E2178 – Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.
- B. Building code standards:
1. SBCCI PST & ESI Evaluation Guide on Floor, Wall, and Roof Systems (Testing for Moisture Protection Barriers), Evaluation Guide 119.
 2. UBC 26-9, Method of Test for the Evaluation of Flammability Characteristics of Exterior, Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
 3. ICBO Acceptance Criteria for Exterior Insulation and Finish Systems, AC 24.
 4. CCMC Technical Guide on Air Barriers.
- C. Gypsum Association:
1. GA-600 – Fire Resistance Design Manual.
 2. GA-253 – Recommended Specifications for the Application of Gypsum Sheathing.
 3. GA-254 – Fire-Resistant Gypsum Sheathing.
- D. American Plywood Association: E30 Residential and Commercial Construction Guide.
- E. Proprietary specifications:
1. 531544 Georgia-Pacific Corporation, “Dens Glass Gold® Exterior Sheathing.”
 2. AATCC (American Association of Textile Chemists and Colorists), Test Method 127, Water Resistance: Hydrostatic Pressure Test.
- F. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE): 2001 ASHRAE Handbook – Fundamentals.

1.04 DESIGN REQUIREMENTS

- A. Deflection criteria: Maximum allowable deflection normal to the plane of the wall is $L/240$.
- B. Wind load: Conform with code requirements.
- C. Moisture control:
 - 1. Minimize condensation within the assembly.
 - 2. Drain water directly to the exterior where it is unlikely to penetrate components in the wall assembly (windows and doors, for example).
 - 3. Provide flashing to direct water to the exterior in accordance with code requirements, including above window and door heads, beneath window and door sills, at roof/wall intersections, decks, intersections of lower walls with higher walls, and at the base of the wall.
- D. Air barrier continuity: Provide a continuous air barrier system of compatible air barrier components.
- E. Mechanical ventilation: Maintain pressurization and indoor humidity levels in accordance with the recommendations of ASHRAE (refer to the 2001 ASHRAE Handbook – Fundamentals).

1.05 PERFORMANCE REQUIREMENTS

- A. PROSOCO R-GUARD™ Water-Resistive/Air Barrier performance data:

Test	Method	Criteria	Results
Aging Water Penetration Resistance	AATCC127 (Water Column)	Resist 21.6 in (55 cm) water for five (5) hours before and after aging.	No water penetration before and after aging. No water penetration at 332" (843 cm) head of water before aging.
Structural Loading Water Penetration Testing	ASTM E1233 ASTM E331	No water at exterior plane of sheathing (exterior gypsum, DensGlass Gold, plywood, OSB) after ten (10) cycles at 80% design load and 75 minutes water spray at 6.24 psf (299 Pa) pressure differential with water spray rate of 5 gal/ft ² -hr (3.4 L/m ² -min).	No water penetration before and after aging. No water penetration at 332" (843 cm) head of water before aging.

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Cyclic Pressure Water Penetration Testing	ASTM E283 ASTM E331	No water penetration or evidence of elevated moisture levels in plywood sheathing after ten (10) cycles of conditioning at 299 Pa (6.24 psf) positive and negative pressure followed by 75 minutes water spray at 6.24 psf (299 Pa) pressure differential with water spray rate of 5 gal/ft ² -hr (3.4 L/m ² -min).	No water penetration before and after aging. No water penetration at 332" (843 cm) head of water before aging.
Water Penetration R-GUARD™ Spray Wrap (8-in medium wt CMU w/2 coats)	ASTM E331	No leakage at 137 Pa (2.86 psf) for fifteen (15) minutes	No leakage at 137 Pa (2.86 psf) for fifteen (15) minutes. No leakage at 300 Pa (6.24 psf) for one hundred twenty (120) minutes.
Water Resistance Testing	ASTM D2247	Absence of deleterious effects after 14-day exposure.	No visible deleterious effects after 14-day exposure.
Resistance to Mold Growth	ASTM D3273	No mold growth after twenty-eight (28) days.	No mold growth after 28-day exposure.
Freeze/Thaw Resistance	ICBO Method (AC 24)	No visible effects (cracking, checking, delamination, erosion) when viewed at 5x.	No visible deleterious effects when viewed at 5x.
Water Vapor Transmission	ASTM E96 Method B (Water Method)	Measure.	R-GUARD™ Fill: 17.3 perms [(994 ng/(Pa s m ²))] R-GUARD™ Spray Wrap: 5.7 perms [(327 ng/(Pa s m ²))]
Air Leakage: Wall Assembly with R-GUARD™ Fill and R-GUARD™ Spray Wrap	ASTM E283 (SBCCI PST & ESI Method)	<0.06 cfm/ft ² at 1.57 psf (0.00030 m ³ /s m ² at 75 Pa)	0.0044 cfm/ft ² (0.000022 m ³ /s m ²)
Air Leakage: R-GUARD™ Fill	ASTM E283 (CCMC Technical Guide Method)	<0.003 cfm/ft ² at 1.57 psf (<0.02 L/s m ² at 75 Pa)	0.0002 cfm/ft ² (0.0014 L/s m ²)
Air Leakage: R-GUARD™ Spray Wrap (8-in medium wt CMU w/2 coats)	ASTM E283 (as specified in ASTM E2178 Section 8.2.8)	<0.004 cfm/ft ² air leakage at 1.57 psf <0.02 L/s m ² air leakage at 75 Pa	<0.004 cfm/ft ² air leakage at 1.57 psf, <0.004 cfm/ft ² air leakage at 6.24 psf <0.02 L/s m ² air leakage at 75 Pa <0.02 L/s m ² air leakage at 300 Pa
Structural Integrity	ASTM E330	2-in (51 mm) water pressure (positive and negative) for one (1) hour.	No loss of structural integrity.
Dry Tensile Strength	ASTM D882	20 lbs./in (3503 N/m) minimum before and after aging.	R-GUARD™ Fill: 159 pli (27.8 kN/m) before aging. 213 pli (37.3 kN/m) after aging.

Flexibility	ASTM D522	No cracking or delamination using 1/8" (3 mm) mandrel at 14° F (-10° C) before and after aging.	No cracking or delamination before or after aging.
Tensile Adhesion	ASTM C297	>15 psi (103 kPa)	Gypsum (ASTM C79): >30 psi (206 kPa) Gypsum (ASTM C1177): >30 psi (206 kPa) Exposure 1 OSB: >50 psi (344 kPa) Exterior plywood: >90 psi (620 kPa)
Surface Burning	ASTM E84	Flame spread <25 Smoke developed: <450	Flame spread: 5 Smoke developed: 10 NFPA Class A, UBC Class 1 building material
Fire Testing	UBC 26-9, NFPA 285	No increase in fire hazard.	Pass.

1.06 SUBMITTALS

- A. Refer to Section 01 33 00 for addition information related to submittal format.
- B. Product data: Submit the manufacturer's product data sheets on all products to be used for project construction. Submit descriptions for protection, surface preparation, and application.
- C. Samples for approval as directed by the Architect or the Owner.

1.07 QUALITY ASSURANCE

- A. Contractor's requirements:
 - 1. Knowledgeable in the proper use and handling of PROSOCO products.
 - 2. Employ skilled installers who are experienced and knowledgeable in air and water-resistive barrier application and who are familiar with the requirements of the specified work.
 - 3. Provide the proper equipment, manpower, and supervision on the job site to install the system in compliance with PROSOCO's published specifications.
- B. Field-constructed mock-up procedures: Supply a sufficient quantity of material for use in constructing mock-ups. Prior to overall installation, apply air and water-resistive barrier system to a mock-up wall; verify details for overall installation. Demonstrate tie-ins with adjoining construction and other termination conditions.
 - 1. Install air and water-resistive barrier mock-ups in the field on assemblies constructed of unit masonry or sheathing. Use the manufacturer's written application instructions.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in their original sealed containers bearing the manufacturer's name and identification of the product.
- B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90° F (32° C). Store away from direct sunlight.

1.09 PROJECT CONDITIONS

- A. Maintain ambient and surface temperatures above 40° F (4° C) and below 100° F (38° C) during application and drying period and for a minimum of twenty-four (24) hours after application of the air and water-resistive barrier.
- B. Provide supplementary heat for installation in temperatures less than 40° F (4° C) or if the surface temperature is likely to fall below 40° F (4° C). Note: The surface temperature is lower than the air temperature at night.

1.10 COORDINATION/SCHEDULING

- A. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors, and other wall penetrations to provide a continuous air and water-resistive barrier.
- B. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.
- C. Provide sill flashing for directing water to the exterior before windows and doors are installed.
- D. Install window and door head flashing immediately after windows and doors are installed.
- E. Install diverter flashings wherever water can enter the assembly for directing water to the exterior.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of design: R-Guard by Prosoco, Inc. (or equal).
- B. Equivalent design: Manufacturer with products of equivalent design may include, but are not limited to:
 - 1. Grace (Perma Barrier).
 - 2. Carlisle.
 - 3. Tremco.
 - 4. Sandelle.

2.02 FLUID-APPLIED MEMBRANE AIR BARRIERS

- A. Prosoco R-Guard (or equal): A fluid-applied air and water-resistive barrier, available in two (2) alternative systems, that stop air and water leakage through structural sheathing, including seams, cracks, fasteners, window, and door openings.
1. System I consists of self-adhesive glass fiber tape, a ready-mixed acrylic compound fill, and a ready-mixed flexible acrylic coating to be applied to structural sheathing.
 - a. R-Guard Tape: 4.25" (11 cm) and 9.5" (24 cm) wide, self-adhesive, flexible, symmetrical, interlaced glass fiber fabric, with alkaline-resistant coating.
 - b. R-Guard Fill:
 - 1) Form: Dark red viscous liquid, mild odor.
 - 2) Specific gravity: More than 1.0.
 - 3) pH: 7.5 – 10.5.
 - 4) Wt/Gal: ASTM D2369, 83%.
 - 5) VOC content: Less than g/L.
 - 6) Flash point: More than 200° F (93° C).
 - 7) Freeze point: 32° F (0° C).
 - c. R-Guard Spray Wrap:
 - 1) Form: Light red viscous liquid, mild odor.
 - 2) Specific gravity: More than 1.0.
 - 3) pH: 7.5 – 10.0.
 - 4) Wt/Gal: 12.7 lbs.
 - 5) Total solids: ASTM D2369, 74%.
 - 6) VOC content: More than g/L.
 - 7) Flash point: More than 200° F (93° C).
 - 8) Freeze point: 32° F (0° C).
 2. System II consists of reinforced, nonwoven fabric for covering sheathing joints and rough openings, preformed fabric for installation at corners inside rough openings, and ready-mixed flexible, acrylic coating to be applied to structural sheathing.

- a. R-Guard Joint Fabric: Nonwoven cloth reinforcement available in 4" (10 cm) or 6" (15 cm) widths for use on sheathing joints, inside and outside corners, and rough openings.
- b. R-Guard EZ Corner: Preformed fabric piece used in the corners of rough openings.
- c. R-Guard Transition Membrane: A 6" (152 mm) wide self-adhering water-resistive air barrier material that functions as alternative protection for rough openings; a secondary seal for sealant joints; or as an air barrier connection material bridging dissimilar materials. Pliable black self-adhering membrane for bridging dissimilar materials. Covering with a coat of R-Guard spray wrap will extend the UV exposure window from thirty (30) days to six (6) months.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Inspect concrete, concrete masonry surfaces, and sheathing to determine suitability for application according to the manufacturer's written instructions.
- B. Report deviations from the requirements of the project specifications or other conditions that might adversely affect the air and water-resistive barrier installation. Do not start work until deviations are corrected.

3.02 SURFACE PREPARATION

- A. Protect people, vehicles, property, plants, and all surfaces not designated to receive treatment from the product from splash and wind drift.
- B. Surfaces must be clean, sufficiently dry, and in good repair.
- C. Surfaces must be free of frost, damage, and all bond-inhibiting materials, including dirt, efflorescence, form oil, and other foreign matter.
- D. Transition membrane:
 - 1. Use Prosoco R-Guard™ Transition Membrane only where a protective covering will be applied within thirty (30) days. Spray wrap may be used to protect the membrane to gain the maximum exposure of six (6) months.
 - 2. Transition membrane is not for use below grade or on surfaces subject to pooling, ponding, or water immersion.
 - 3. Surfaces must be clean, dry, smooth, and free of grease, dust, oil, and any other surface contamination.
 - 4. Do not apply over uncured sealants or materials containing plasticizers.
 - 5. Depending on conditions, the substrate may have to be primed for best results.

3.03 EQUIPMENT

- A. Use a seam roller or other blunt tool to firmly adhere R-Guard™ Tape over sheathing joints to the wall. To reduce any potential for damage to the R-Guard™ Tape, round the sharp corners of tools used for installation.
- B. Stir fill and spray wrap as required to a uniform consistency with a clean, rust-free electric drill and paddle.
- C. Apply fill with a trowel, roller, or texture sprayer. Texture sprayers should have a maximum working pressure of 100-120 psi (7-8.3 bar) and a maximum delivery rating of 2.0-4.0 gpm (7.5-15.1 lpm). Fill is compatible with GRACO TexSpray™ TTX 1500 and GTX 2000 equipment.
- D. Apply R-Guard Spray Wrap with a roller, texture sprayer, or airless sprayer capable of providing a minimum output rate of one (1) gallon per minute. Use a ¾" (19 mm) nap roller when roller applying to GP DensGlass Gold, Oriented Strand Board (OSB). Use a ½" (13 mm) nap roller when roller applying to plywood or exterior gypsum sheathing. R-Guard Spray Wrap is compatible with Graco Ultra Max II airless sprayer 795 with a 27 thousandth's tip
- E. Apply R-Guard MVP with a roller, texture sprayer, or airless sprayer capable of providing a minimum output rate of one (1) gallon per minute. Use a ½" (13 mm) nap roller when roller applying to GP DensGlass Gold, exterior gypsum sheathing, oriented strand board (OSB), or plywood. Use a ¾" (19 mm) nap roller when roller applying to CMU back-up. R-Guard MVP is compatible with Graco Ultra Max II airless sprayer 795 with a 27 thousandth's tip.

3.04 INSTALLATION

- A. System I, application instructions:
 - 1. Structural sheathing:
 - a. Exterior gypsum sheathing board:
 - 1) Apply 4.25" R-Guard Tape over sheathing joints and seams. Fold and apply 9.5" R-Guard Tape to rough openings and inside and outside corners. Use a seam roller or other blunt tool to firmly adhere mesh tape to sheathing.
 - 2) Uniformly cover R-Guard Tape and about 4" of sheathing on either side of the R-Guard Tape with R-Guard Fill using a trowel, roller, or texture sprayer. Trowel smooth. Spot over-driven fasteners and surface defects with R-Guard Fill or paintable caulk. Let dry.
 - 3) Spray-apply or roller-apply R-Guard Spray Wrap or MVP to the entire surface to a uniform wet mil thickness of 10 mils, including areas covered by R-Guard Tape and R-Guard Fill. Let dry.

B. System II, application instructions:

1. Structural sheathing:

a. Exterior gypsum sheathing board:

- 1) Liberally apply R-Guard Spray Wrap or MVP by spray or roller to all vertical and horizontal sheathing joints.
- 2) Embed R-Guard Joint Fabric.
- 3) Apply R-Guard Spray Wrap or MVP over the R-Guard Joint Fabric. Spot over-driven fasteners and surface defects with R-Guard Fill or paintable caulk. Let dry.

2. Rough openings (sheathing):

- a. Using a roller or sprayer, apply a liberal coat of R-Guard Spray Wrap or MVP in the corners of the rough opening to the face of the sheathing and around the corners.
- b. Place R-Guard EZCorner on the inside of the rough opening with the tabs oriented so they are on the face of the sheathing. Embed R-Guard EZCorner in the wet coating. Repeat until all corners have been treated.
- c. After all corners have been installed, apply a liberal coat of R-Guard Spray Wrap or MVP to the entire rough opening.
- d. Embed R-Guard Joint Fabric into the wet coating. Overlap R-Guard EZCorner by at least 2" (51 mm) with the R-Guard Joint Fabric.
- e. Once the entire rough opening has been treated, top-coat the fabric with R-Guard Spray Wrap or MVP. Inspect the treated rough opening for pinholes. If found, apply more coating until the pinholes are filled.

3. R-GUARD Transition Membrane, application instructions:

- a. Apply R-Guard Transition Membrane at ambient temperatures above 50° F (10° C) whenever possible. When applying in cooler weather, keep R-Guard Transition Membrane warm and prime the surface with spray adhesive. Warming the material with an electric heat gun may improve bondability.
 - 1) Cut R-Guard Transition Membrane to the desired length.
 - 2) Remove release film on back.
 - 3) Place R-Guard Transition Membrane over surfaces to be covered and press firmly into place. Lap seams a minimum of 2" (51 mm). Shingle-lap horizontal seams.

3.05 CURING AND DRYING

- A. Complete drying times vary depending upon temperature, humidity, and surface conditions. Protect from rain or freezing until completely dry. Under normal conditions [70° F (21° C), 50% RH]:
 - 1. R-Guard™ Fill dries to the touch and can be over-coated in four (4) hours.
 - 2. R-Guard™ Spray Wrap dries to touch and can be over-coated in two (2) to four (4) hours.

3.06 CLEAN-UP

- A. Clean tools and equipment with water immediately after use. Dried material must be removed mechanically.

3.07 FIELD QUALITY CONTROL

- A. Inspection: Inspect the fluid-applied membrane system installation with the Architect.
- B. Manufacturer's field services: Attend a field meeting to verify that the specified products are used and that protection, surface preparation, and installation are in accordance with the manufacturer's written application instructions.

END OF SECTION

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Install new lead pipe or neoprene flashing at vent stacks.
- B. Related sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 13 34 19 – Metal Building Systems

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit product data which includes detailed specifications and applicable field measurements.

PART 2 - PRODUCTS

2.01 PREFINISHED METAL

- A. Equal to MBCI or Colorklad 26 gauge prefinished metal. Color as selected by the Owner and the Architect.

2.02 PIPE FLASHING

- A. Preformed 16 oz. lead sized as per penetration.
- B. Neoprene: Equal to Deck Mate.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Work included:

1. Clean and prepare joint surfaces.
2. At building exterior, install backing materials and sealant around louvers, vents, and door and window frames.
3. Install caulking at the junction of gypsum board and dissimilar materials.
4. At control and expansion joints, install backer rod and sealant.
5. Sealant at the junction of plumbing fixtures and adjacent materials.

B. Related sections:

1. Section 04 21 13 – Brick Masonry
2. Section 04 22 00 – Concrete Unit Masonry
3. Section 08 11 13 – Hollow Metal Doors and Frames
4. Section 08 41 00 – Aluminum-Framed Entrances and Storefronts
5. Section 09 29 00 – Interior Gypsum Board
6. Section 09 91 00 – Painting
7. Division 22 – Plumbing
8. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
9. Division 26 – Electrical
10. Division 27 – Communications
11. Division 28 – Electronic Safety and Security

1.02 WARRANTY

- A. Provide a five-year warranty for exterior sealants.**
- B. Warranty: Replace sealants which fail because of loss of cohesion or adhesion or which do not cure.**

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit detailed product data on each sealant. Product data is to include installation instructions, including joint preparation and back-up rod recommendations for the specific sealant.

PART 2 - PRODUCTS

2.01 SEALANT MATERIALS

- A. Back-up rod: Filler backing shall be polyethylene foam or polyurethane foam, rods or stops as required.
- B. Primers: As recommended by the sealant manufacturer.
- C. Sealant for use around exterior window and door frames, vertical expansion joint/control joints:
 - 1. One-part, low modulus, oxygen-curing polyurethane equal to Permapol RCI.
 - 2. Color shall match adjacent materials at exterior, paintable at interior. Submit samples for the Architect's approval.
- D. Caulking: Acrylic latex to match the color of adjacent materials. Caulking shall be paintable and equal to White Lightning 3060. DAP and Sherwin Williams approved equals.
- E. Sealant at plumbing fixtures: Silicone to match the color of fixtures.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that joint dimensions and physical and environmental conditions are acceptable to receive the work of this section.
- B. Beginning of installation means acceptance.

3.02 PREPARATION

- A. Clean, prepare, and size joints in accordance with the manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.
- B. Verify that joint-shaping materials and release tapes are compatible with sealant.
- C. Examine joint dimensions and size materials to achieve required width/depth ratios.
- D. Use joint filler to achieve required joint depths to allow sealants to perform properly.

3.03 INSTALLATION

- A. Perform work in accordance with ASTM C804 for solvent release sealants.
- B. Install sealant in accordance with the manufacturer's instructions.
- C. Apply sealant within the recommended temperature ranges. Consult the manufacturer when sealant cannot be applied within the recommended temperature ranges.
- D. Tool joints concave.
- E. Joints more than $\frac{3}{4}$ " deep and joints where a suitable backstop has not been provided shall be packed with rope to within $\frac{1}{2}$ " of the surface before applying caulking.

END OF SECTION

SECTION 08 11 10
FEMA 361 STORM-RESISTANT DOORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The General Conditions of the Contract and Division 1 of the specifications govern this section.
- B. All doors, frames, and accessories in this section shall be compliant with FEMA 361 3rd Edition/March 2015 and ICC 500-2014 as tested by the National Wind Institute. Refer to www.depts.ttu.edu/nwi/research/shelters.php.
- C. If components furnished under this section have not been tested and approved by the National Wind Institute, the manufacturer of the product shall submit a sample to the National Wind Institute for testing or shall use a component that has been tested and approved by a qualified independent testing facility to meet FEMA 361 3rd Edition/March 2015 standard. Only when the component has been successfully testing and approved will it be eligible for the project. If components used were testing by a qualified independent testing facility, all testing documentation and results must be submitted to the State of Mississippi for approval before incorporating them into the design. The testing report shall conclusively indicate and certify that the component passes and meets FEMA 361 3rd Edition/March 2015 standards by the independent testing facility. If lieu of the testing documentation, the submittal may include the certification with a seal of approval from the testing facility. The Architect, however, reserves the right to require any and all testing data. Miami Date testing or any equal/equivalent to FEMA 361 3rd Edition/March 2015 is not acceptable.

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal requirements.
- B. Submit full documentation that doors, frames, hardware, and components have been tested and are in compliance with FEMA 361 3rd Edition/March 2015 and ICC 500-2014 for tornadic (Protocol 4) impact winds and cyclic loading and is in compliance with testing by the Wind Scientific and Engineering Research Center at Texas Tech University.
- C. Provide all details of head, sill, and jambs and complete information on installation criteria.
- D. Provide all FEMA 361 testing technical data certification documents with submittals.

1.03 APPROVED PRODUCTS/MANUFACTURERS

- A. Republic Doors & Frames, 155 Republic Drive, McKenzie, Tennessee 38201; telephone: (800) 733-366.
- B. Master Security Doors, Inc., 2179 North Powerline Road, Suite 2, Pompano Beach, Florida 33069; telephone: (954) 971-4747; fax: (954) 971-4925.

C. Ceco Door, 9159 Telecom Drive, Milan, Tennessee 38358; telephone: (888) 264-7474; fax: (731) 465-9975.

D. Or equal.

PART 2 - PRODUCTS

2.01 DOOR AND FRAME SYSTEM

A. Door: 15 gauge cold rolled face sheets, 12 gauge liner with 14 gauge top and bottom channels, 14 gauge welded top cap and polystyrene core. Prime paint.

B. Frame: 14 gauge cold rolled steel. Prime paint.

2.02 FRAMING FASTENERS

A. All internal framing fasteners will be Type 18-8 stainless steel.

2.03 JOINTS AND CONNECTIONS

A. All joints and connections shall be tight, providing hairline joints and true alignment of adjacent members.

2.04 ADDITIONAL DOOR COMPONENTS/PERFORMANCE

A. Panels shall not be removable from the threat side.

B. Multipoint exit devices.

C. Removable center mullion.

D. Coordinate with hardware supplier.

E. Continuous hinge.

F. Closures.

G. Saddle threshold, weatherstripping, and bottom sweeps.

PART 3 - EXECUTION

3.01 STORAGE

A. Raise on skids and protect from rain. Materials shall not be in contact with wet materials.

3.02 INSTALLATION

A. Provide temporary midpoint spreader until firmly built in.

B. Use all anchors provided. Position and secure anchors so that they hold the frame securely and as outlined in the FEMA test assembly.

- C. Touch up damaged primer so that the in-place work is ready for finish painting.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Hollow metal doors and glass.
- B. Hollow metal frames and glass.
- C. Coordination of frames for gypsum board and/or masonry walls

1.02 RELATED WORK

- A. Section 04 05 13 – Masonry Mortaring
- B. Section 04 21 13 – Brick Masonry
- C. Section 04 22 00 – Concrete Unit Masonry
- D. Section 08 14 16 – Flush Wood Doors
- E. Section 08 71 00 – Door Hardware
- F. Section 09 91 00 – Painting (field-painting of hollow metal doors and frames)

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit shop drawings and product data to the Architect.
- C. Indicate door elevations, internal reinforcement, and closure method.

1.04 COORDINATION

- A. Field-verify all opening dimensions and installation conditions prior to ordering steel doors and frames.
- B. Coordinate door/frame preparation with the approved finish hardware schedule, wall types, door types, and alternates.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Curries or approved equal.

2.02 HOLLOW METAL DOORS

- A. Fabricate doors from 16 gauge galvanized steel. The tops and bottoms of all doors are to be closed flush, filled, and ground smooth. Exterior doors shall be galvanized.
- B. Exterior doors shall be insulated with rigid foam.
- C. Doors and frames shall receive hardware reinforcing at hinges and strikes and for any surface-applied items.
- D. Vertical stiffeners of doors shall be welded to the inner side of the surface sheets at 6" c.c.
- E. Channel stiffeners are required at the top and bottom of doors to insure rigidity. Voids between stiffeners are to be insulated for sound-deadening.
- F. All doors shall be thoroughly cleaned of shop oils after fabrication, treated for paint adherence, and painted one (1) coat of high grade zinc chromate primer, which shall be oven-dried.
- G. Full louver exterior doors shall be furnished with insect screen.
- H. All glass in hollow metal doors shall be impact-rated.
 - 1. Refer to Section 08 81 00 – Glass Glazing.

2.03 HOLLOW METAL FRAMES

- A. Interior frames: 16 gauge cold-rolled steel.
- B. Exterior frames: 14 gauge cold-rolled steel, galvanized.
- C. All frames shall be welded.
- D. Furnish with pressure-applied rubber silencers.
- E. All frames shall have 9 gauge steel hinge reinforcement plates and 14 gauge strike reinforcement plates.
- F. Furnish a minimum of six (6) anchors per opening. All frames shall have an integral or welded-on sill anchor. Anchors at drywall partitions shall be “Z” clips welded to frames. Tee anchorage devices at masonry walls.
- G. All frames shall be thoroughly cleaned, phosphatized, and finished as standard with one (1) coat of baked-on, rust-inhibiting gray prime coat.
- H. All glass in hollow metal doors shall be impact-rated.
 - 1. Refer to Section 08 81 00 – Glass Glazing.

PART 3 - EXECUTION

3.01 STORAGE

- A. Stack and store doors properly to protect material from harmful elements and damage while stored at the job site.
- B. Upon delivery, touch up damaged areas of the finish with a rust-inhibitive metal primer.

3.02 INSTALLATION

- A. Hang doors plumb and true, with uniform clearances on all sides.

3.03 ADJUSTMENT AND CLEANING

- A. Remove dirt and excess sealants from exposed surfaces.
- B. Touch up marred or abraded surfaces to match their original finish.
- C. Adjust doors for smooth and balanced door movement.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Solid core, flush wood doors.
 - 2. Fire-rated, solid core, flush wood doors.
- B. Related sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 08 11 13 – Hollow Metal Doors and Frames
 - 3. Section 08 71 00 – Door Hardware
 - 4. Section 08 81 00 – Glass Glazing
 - 5. Section 09 91 00 – Painting

1.02 REFERENCES

- A. WDMA – Window and Door Manufacturers Association: IS 1-A 1997 Industry Standard for Architectural Flush Wood Doors.
- B. NFPA-80 Standards for Fire Doors, latest edition.
- C. NFPA-105 Recommended Practice for Installation for Smoke-Control Door Assemblies, latest edition.
- D. AWI – Quality Standards of Architectural Woodwork Institute.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Shop drawings and product data: Indicate door elevations, general construction, stile and rail enforcement, core composition jointing methods, hardware and louver locations, internal blocking for hardware attachment, and locations of cutouts for glass. Indicate thickness of veneers.
- C. Samples: Submit samples of wood veneer and factory finishing in accordance with WDMA Quality Standards I.S. 1-A, latest edition.
- D. Certification: Submit certification that doors and frames comply with the specified fire ratings and UL listings.

1.04 QUALITY ASSURANCE

- A. Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies with local code standards and which are labeled and listed for the ratings indicated by ITS – Warnock Hersey, UL, or other testing and inspection agency acceptable to authorities having jurisdiction.
- B. WDMA: Window and Door Manufacturers Association Quality Standards for grade of door, core, construction, finish, and other requirements.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, moisture damage, or deterioration. Store doors flat on a level surface in a dry, well ventilated building.
- B. Doors should not be subject to abnormal heat, extreme dryness, or relative humidity less than 30% or more than 60%.

1.06 WARRANTY

- A. Wood doors shall be warranted for one (1) year from the date of substantial completion.

1.07 COORDINATION

- A. Take special care to coordinate door preparation with the requirements of the approved finish hardware schedule.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Marshfield.
- B. Graham Manufacturing.
- C. Eggers Industries.
- D. Algoma Hardwoods.

2.02 MATERIALS

- A. AWI Premium Grade, book-matched veneers.
- B. Five-ply construction using three-ply hardwood faces.
- C. Thickness: 1¾".
- D. Stiles: 1½" hardwood to match face veneer over structural composite lumber glued to core.

- E. Rails: Mill option hardwood or structural composite lumber. Top and bottom: 2" before trim or factory fit.
- F. Facing: Wood veneer cut and species as specified shall conform to WDMA.
- G. Hardware: Pre-routed for butts, machined for lockset. Coordinate with the requirements of the approved finish hardware schedule.
- H. Fire rating: Refer to the Door/Frame Schedule.
- I. Wood veneer:
 - 1. Door face veneers shall meet quality standards conforming to WDMA "A" grade or "AA" grade for transparent or semi-transparent finish. Minimum face veneer thickness: 1/50" at 12% moisture content after finish sanding.
 - 2. Species: Birch.
 - 3. Cut and assembly: Rotary cut, book match.
- J. Adhesives:
 - 1. Face-to-core adhesives shall be Type I or Type II as appropriate for the location in the building. Adhesives must be classified Type I or Type II per WDMA specification for "Adhesive Bond Test Method."
 - 2. Type I adhesives shall be used for doors in exterior applications. Type II adhesives shall be used for doors in interior applications.
- K. Core:
 - 1. Non-rated and 20-minute doors: Solid particleboard.
 - 2. Fire-rated doors: Non-combustible mineral core containing no asbestos.

2.03 ACCESSORIES

- A. Vision panels shall be metal beveled frames with fire and impact glass as required. Refer to Section 08 81 00 – Glass Glazing.
- B. Provide and install louvers, as scheduled. Louvers shall be metal, sight-proof, V-slat.

2.04 FABRICATION

- A. Fabricate wood doors in accordance with the requirements of WDMA's Quality Standards.
- B. Fabricate fire-rated doors in accordance with the requirements of ITS – Warnock Hersey or Underwriters Laboratories with metal label on each door.
- C. Provide doors with minimum 1/4" thick edge strips, of wood species to match face veneers except as required for fire rating.

- D. Make cutouts and provide stops for glass and louvers. Install metal door louvers. Seal cutouts prior to installation of moldings.
 - 1. For full light doors, provide cutout from flush wood door, with vertical grain direction.
- E. Bevel lock and hinge edges of single-acting doors 3° or 1/8" in 2". Radius the strike edge of double-acting swinging doors as required by the hinge manufacturer.
- F. Prepare doors to receive hardware. Refer to Section 08 71 00 – Door Hardware.
 - 1. Pre-fit and bevel to net opening size less approximately 1/4" in width on single swing doors, 3/16" in width for paired doors. Provide 1/4" clearance above the finished floor unless otherwise indicated on the drawings. Provide 1/8" clearance at the top of the door.
 - 2. Slightly ease vertical edges.
 - 3. Machine-cut relief for hinges and machining for handsets. Coordinate with the requirements of Sections 08 11 13 and 08 71 00.
- G. On fire-rated pairs of doors greater than twenty (20) minutes, supply overlapping astragals or metal edge sets only as required by NFPA or by the door manufacturer's fire door authorities. If an astragal is required, to comply with fire-rated labeling requirements for pairs of doors, provide the door manufacturer's standard tested astragal.

2.05 FACTORY FINISHING

- A. Comply with the referenced WDMA specification for factory finishing for premium grade factory finish systems.
- B. Pre-finish wood doors at the factory.
- C. Finish: Selected by the Owner and the Architect from standard finishes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine installed door frames before hanging doors.
- B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and that they have been installed with plumb jambs and level heads.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Handle doors in accordance with the recommendations of WDMA's "Care and Installation at the Job Site."

- B. Condition doors to average temperature and humidity in the area of installation for not less than forty-eight (48) hours prior to installation. Store doors per the recommendations of WDMA's "Care and Installation at the Job Site."
- C. Install doors in a neat and workmanlike manner, free from hammer or tool marks and open joints or slivers.
- D. Install doors in accordance with the manufacturer's instructions.
- E. Set doors plumb, level, square, and true. Install work after the building humidity is at an acceptable level.
- F. Remove and replace all doors that are warped, twisted, bowed, or otherwise damaged. Do not install doors that cannot be properly fitted to their frames.
- G. Adjust doors and hardware and other moving or operating parts to function smoothly and correctly.
- H. Ensure that smoke gaskets are in place before the installation of doors.
- I. Prepare doors to receive finish hardware in accordance with AWI requirements. Coordinate door preparation with the requirements of the finish hardware schedule.
- J. Conform to AWI requirements for fit tolerances.
 - 1. Maximum diagonal distortion: $\frac{1}{8}$ " measured with a straight edge corner to corner.

3.03 ADJUSTING AND CLEANING

- A. Adjust for smooth and balanced door movement.
- B. Clean all doors, glass, and hardware. Remove all markings.
- C. Refinish or replace doors damaged during installation.

END OF SECTION

SECTION 08 33 23
OVERHEAD INSULATED COILING DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Overhead insulated coiling doors for exterior use.

1.02 RELATED SECTIONS

- A. Section 04 22 00 – Concrete Unit Masonry
- B. Section 05 50 00 – Metal Fabrications
- C. Section 06 10 00 – Rough Carpentry
- D. Section 09 91 00 – Painting

1.03 REFERENCES

- A. NFRC 102 – Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.
- B. ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.
- C. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- D. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM A 666 – Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- F. ASTM A 924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- G. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- H. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
- I. NEMA MG 1 – Motors and Generators.

1.04 DESIGN/PERFORMANCE REQUIREMENTS

- A. Overhead insulated coiling doors:

1. Wind loads: Design the door assembly to withstand wind/suction load of 20 psf without damage to the door or assembly components in conformance with ASTM E330.
 2. Operation: Design the door assembly, including the operator, to operate for not less than 20,000 cycles.
- B. Single-source responsibility: Provide doors, tracks, and accessories from one (1) manufacturer for each type of door. Provide secondary components from a source acceptable to the manufacturer of primary components.

1.05 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit product data which includes detailed specifications and applicable field measurements.

1.06 QUALITY ASSURANCE

- A. Manufacturer's qualifications: Company specializing in performing the work of this section with a minimum of five (5) years of experience in the fabrication and installation of security closures.
- B. Installer's qualifications: Company specializing in performing the work of this section with a minimum of three (3) years of experience and approved by the manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store products in the manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

1.08 PROJECT CONDITIONS

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

1.09 COORDINATION

- A. Coordinate the work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

- A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, is to be free from defects in materials and workmanship for three (3) years or 20,000 cycles, whichever occurs first.

- B. Warranty: Manufacturer's limited door warranty for two (2) years for all parts and components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable manufacturer: Overhead Door Corporation, 2501 South State Highway 121 Business, Suite 200, Lewisville, Texas 75067; telephone: (800) 929-DOOR.
- B. Or equal.

2.02 INSULATED OVERHEAD COILING SERVICE DOORS

- A. Overhead coiling insulated service doors: Overhead Door Corporation Model 625, Overhead Coiling Stormtite Insulated Service Doors.
 - 1. Curtain: Interlocking roll-formed slats as specified. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - a. Flat profile type F-265i for doors up to 40' (12.19 m) wide.
 - b. Front slat fabricated of 22 gauge galvanized steel.
 - c. Back slat fabricated of 22 gauge galvanized steel.
 - d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
 - 1) R-Value: 7.7.
 - 2) U-Value: 0.13.
 - 2. Finish:
 - a. Galvanized steel: Slats and hood shall be galvanized in accordance with ASTM A653 and shall receive a rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint.
 - 1) Baked-on prime paint: Color is to be selected from gray, tan, white, or brown.
 - 3. Weatherseals:
 - a. Air infiltration package, IECC 2012/2015 listed; product is to meet C402.4.3 2012; air leakage <1.00 cfm/ft².
 - 1) Air infiltration perimeter seal package shall include the following: guide cover, guide cap, dual brush exterior guide seal, 4" finned lintel brush seal, and vinyl bottom seal.

4. Bottom bar: Two (2) prime painted steel angles, minimum thickness $\frac{1}{8}$ " (3 mm), bolted back-to-back to reinforce curtain in the guides.
5. Guides: Three (3) structural steel angles.
 - a. Finish: PowderGuard Weathered finish with iron/black powder.
6. Brackets: Hot rolled prime painted steel to support counterbalance, curtain, and hood.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel supporting the curtain with deflection limited to 0.03" per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood: Provide with an internal hood baffle weatherseal.
 - a. 24 gauge galvanized steel with intermediate supports as required.
9. Manual operation: Chain hoist.
10. Windload design: Standard windload is 20 psf.
11. Locking: Chain keeper locks for chain hoist operation.
12. Wall mounting condition: Face-of-wall mounting.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify the Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Install in accordance with the manufacturer's instructions.
- B. Use anchorage devices to securely fasten the assembly to the wall construction and building framing without distortion or stress.

- C. Securely and rigidly brace components suspended from the structure. Secure guides to structural members only.
- D. Fit and align assembly, including hardware, level and plumb to provide a smooth operation.
- E. Coordinate installation of sealants and backing materials at frame perimeter.
- F. Install perimeter trim and closures.
- G. Instruct the Owner's personnel in proper operating procedures and maintenance schedule.

3.04 ADJUSTING

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for a smooth and noiseless operation.

3.05 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by the manufacturer.
- B. Remove labels and visible markings.
- C. Touch up, repair, or replace damaged products before the date of substantial completion.

3.06 PROTECTION

- A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. New aluminum framing.

1.02 RELATED WORK

- A. Section 07 92 00 – Joint Sealants
- B. Section 08 71 00 – Door Hardware
- C. Section 08 81 00 – Glass Glazing

1.03 WARRANTY

- A. Provide a five-year manufacturer's warranty on glazing and one-year warranty on parts, material, and installation. Said warranty shall include coverage of sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Shop drawings:
 - 1. Showing construction of all parts, metal thicknesses, and installation and erection details including connections, anchorage, and fastening and sealing methods.
 - 2. Sections of typical members, dimensioned elevations, frame sizes, spacing of anchors and fasteners, and details of accessories.
 - 3. The Contractor is responsible for all field-dimension coordination.
 - 4. Coordinate the preparation of frames with the approved finish hardware schedule.

PART 2 - PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Kawneer 451T.
- B. Similar products by Vistawall and EFCO will be considered equal.

2.02 ALUMINUM FRAMING

- A. 2" x 4½" thermally broken.
- B. Head/jamb receptor and subsill are required at masonry installations.

- C. Glazing: As scheduled.
- D. Finish: Selected by the Owner and the Architect from standard Permafluor colors.

2.03 OPERABLE WINDOWS

- A. Egress window component: Kawneer, Glass Vent. Outswing casement, hinge opening to a maximum of 60°.
- B. Finish: Permafluor architectural coating.
- C. Egress windows in classrooms shall maintain a minimum of 720 sq. in. of egress width.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Assure that window openings conform to the dimensions and tolerances shown on the plans. All dimensions shall be field-verified prior to fabrication.
- B. Check that surfaces to contact windows are free of debris.
- C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 ASSEMBLY

- A. Window wall frames shall be accurately joined at corners with unexposed screws in extruded splines, which are an integral part of all horizontal members. All joints shall be sufficiently caulked to achieve a watertight seal.
- B. Where aluminum comes in contact with masonry, concrete, mortar, plaster, or dissimilar material, apply a heavy coat of bituminous paint.

3.03 ERECTION

- A. All openings shall be prepared plumb and square by others and the window wall frames shall be of sufficient size to provide the required clearances at head, jambs, and sill. Installation and glazing shall be performed by experienced technicians. All units shall be securely anchored and ready for operation. The subsill is to be set in two (2) heavy beads of sealant and an interior bead between the subsill back-let and sill or floor. Subsill ends shall be filled with sealant to insure no water penetration to corners.
- B. Furnish and apply a sealant that is compatible with window systems to provide a completely watertight installation at all joints. Wipe off excess sealant and leave exposed surfaces and joints clean, uniform, and smooth.

3.04 CLEANING

- A. Final cleaning of window frames and glass shall be performed by the General Contractor.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Hardware for all new interior and exterior doors.
 - 2. Refer to finish hardware and Door and Frame Schedule.
- B. Related sections:
 - 1. Section 01 21 00 – Allowances
 - 2. Section 08 11 13 – Hollow Metal Doors and Frames
 - 3. Section 08 14 16 – Flush Wood Doors

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the following:
 - 1. A schedule indicating the type, manufacturer's name, manufacturer's number, location, and finish of each item required.
 - 2. Photographic/graphic cut sheets for every item specified.
 - a. Bind cut sheets in a neat booklet.
 - b. Bind product cut sheets in the order the products are listed in Part 2 of this section.
 - c. Clearly mark appropriate options or highlight options for the Architect's selection.
- C. Submittals failing to meet the above requirements will be rejected until all requirements are met.
- D. In addition to the requirements above, the Contractor may be requested to provide additional technical literature, samples, drawings, and/or performance data to assist in the evaluation of proposed equals.
- E. Secure the approval of the Owner and the Architect before ordering hardware or templates.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Provide storage and protection for finish hardware when delivered and install it when ready.

1.04 QUALITY ASSURANCE

- A. Meet the requirements and recommendations of the applicable portions of the standards listed:
 - 1. American Society for Testing and Materials (ASTM).
 - 2. Commercial Standards (CS).
 - 3. 2018 International Building Code (2018 IBC).
 - 4. Federal Specifications (FS).
 - 5. Americans with Disabilities Act, Accessibility Guidelines (ADAAG).
- B. The supplier of finish hardware shall strictly comply with the following requirements:
 - 1. The supplier shall have been in the full-time business of selling finish hardware for a minimum of ten (10) consecutive years.
 - 2. The supplier shall employ a full-time certified architectural hardware consultant (AHC).
 - 3. The supplier shall be a member in good standing with DHI.
 - 4. The supplier shall be a factory-authorized dealer of the approved hardware.
 - 5. The supplier shall be approved by the Owner and the Architect.

1.05 GENERAL REQUIREMENTS

- A. Properly tag, index, and file keys as directed and deliver all keys at completion of the work.
- B. Fire underwriters' labels: Provide only hardware having the same UL label and fire exposure time rating as the doors and frames to which they are applied. This provision supersedes any hardware schedule provisions to the contrary.
- C. Any revisions of the hardware schedule to conform to the details shall be provided. Items not specifically mentioned but necessary for the completion of the work shall be furnished. In those places where specific hardware is not mentioned, it shall be the Contractor's responsibility to furnish hardware of a quality equal to that of other openings used for the same general purpose. The cost of any such hardware shall be included in the original bid.

1.06 KEYING

- A. Key to “Best” systems as directed by the Owner.
- B. Furnish four (4) master keys and/or four (4) grand master keys. Furnish two (2) keys per lock otherwise.

1.07 COORDINATION

- A. Strictly coordinate the machining of wood doors and the preparation of hollow metal doors/frames with the approved finish hardware schedule.

1.08 FINISHES

- A. Generally shall be dull chrome (26D) unless otherwise noted in the Schedule.

PART 2 - PRODUCTS

2.01 DOOR HARDWARE

- A. Hinges: Equal to square-edged, full mortise Hager BB 1279, 4½" x 4½".
- B. Spring hinges: Equal to square-edged, full mortise Hager 1250, 4½" x 4½".
- C. Locksets: Equal to Best 45H, Sargent 8200, Schlage L9000 commercial heavy duty mortise locks:
 - 1. Best removable cores are required.
 - a. Cylinders, cores, and core installation are to be purchased from Best under the allowance established in Section 01 21 00.
 - b. Locksets and panic devices shall be supplied less cores.
 - c. Installation and operational adjustments of cylinders in all locksets and panic devices is the responsibility of the Contractor, and the labor for such shall be included in the Base Bid.
 - d. Cylinders and construction cores shall be installed by the Contractor.
 - e. Permanent cores are to be installed by the Contractor as directed by the Owner.
 - 2. Function as per the hardware schedule.
 - 3. Lever type design (ADA-compliant equal to Best #14).
 - 4. Escutcheon equal to Best Type “J.”
 - 5. Complete with strike.
- D. Deadbolts: Equal to Best 83T.

- E. Occupancy indicator deadbolts: Equal to Falcon D 871626 with 2¾" backset, ADA-compliant lever, and external emergency release.
- F. Closers: Equal to Sargent 281 Powerglide Series, LCN 4040, Corbin Russwin DC8000 cast iron, standard duty (in Sargent line).
 - 1. Through-bolt all closers.
- G. Exit devices: Equal to Von Duprin 99/98, Sargent 8800/8700, Precision Apex 2000, 33/35 Series.
 - 1. Cylinders, cores, and core installation are to be purchased from Best under the allowance established in Section 01 21 00.
 - 2. Through-bolt all exit device hardware.
 - 3. Cylinder dogging is required with key (hex key is not acceptable).
- H. Flush bolts: Equal to Rockwood 555.
- I. Surface bolts: Equal to Rockwood 630.
- J. Hold open stops: Equal to Rockwood 461.
- K. Kickplates:
 - 1. Equal to Rockwood or TRIMCO 8" high x width of door minus 2".
 - 2. Thickness: 0.050".
 - 3. Smooth finish.
- L. Doorstops:
 - 1. Manufacturer: Rockwood, TRIMCO, or equal.
 - 2. Type: Equal to Rockwood #440 Series. Provide complete with #449 riser if required for stable installation.
- M. Doorstops (wall-mounted):
 - 1. Manufacturer: Rockwood, TRIMCO, or equal.
 - 2. Type: Equal to Rockwood #406 Series, stainless steel.
- N. Thresholds and weatherstripping:
 - 1. Thresholds: PEMKO 2005AV or 181AV.
 - 2. Ramped thresholds: Equal to National Guard Products 952.
 - 3. Weatherstripping: PEMKO 305CR (neoprene).

4. Door bottom: PEMKO 211AV.

O. Silencers are required at all hollow metal frames.

2.02 SCHEDULE

A. Refer to Section 01 21 00 – Allowances. The supplier shall prepare and submit a complete schedule to the Architect for review.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide storage and protection for finish hardware when delivered and install when ready.
- B. Fit all hardware accurately, apply securely, and adjust properly. Leave in good working order, free of defects.
- C. Properly tag, index, and file keys as directed and deliver all keys at completion of the work.
- D. Apply hardware in accordance with the manufacturer's instructions; fit accurately, apply securely, and adjust carefully. Use care not to injure work when applying hardware. When necessary, remove and replace doors so they may have all surfaces painted.

3.02 APPLICATION OF HARDWARE

- A. Receive, store, and be responsible for all finish hardware. Properly tag, index, and file all keys in key cabinet or as directed. Apply hardware in accordance with the manufacturer's instructions; fit accurately, apply securely, and adjust carefully. Use care not to injure work when applying hardware. When necessary, remove and replace doors so that they may have their tops and bottoms painted or stained.
- B. The location of hardware in connection with wood doors and metal door bucks shall be as follows unless otherwise shown on the drawings:
 - 1. Center door knobs and levers 38" above the finished floor.
 - 2. Center door pulls 40" above the finished floor.
 - 3. Center push plates 45" above the finished floor.
 - 4. Center cylinder dead bolt locks 52" above the finished floor.
 - 5. Center single push bars 48" above the finished floor.
 - 6. Locate the upper edge of top hinges 5" below the head of the frame.
 - 7. Locate the lower edge of bottom hinges 10" above the finished floor.

8. Space center hinges an equal distance between top and bottom hinges.

END OF SECTION

SECTION 08 81 00
GLASS GLAZING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Glass and glazing.

1.02 RELATED WORK

- A. Section 07 92 00 – Joint Sealants
- B. Section 08 11 13 – Hollow Metal Doors and Frames
- C. Section 08 14 16 – Flush Wood Doors

1.03 CODES AND STANDARDS

- A. Glass and glazing procedures must comply with the requirements of the 2018 International Building Code.
- B. Furnish/install tempered glass in locations required by codes.

1.04 WARRANTY

- A. Provide a five-year manufacturer's warranty on glazing and one-year warranty on parts, material, and installation. Said warranty shall include coverage of sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 - PRODUCTS

2.01 GLAZING SCHEDULE

- A. All insulated glazing shall be 1" thick.
 - 1. Exterior pane:
 - a. Exterior pane Surface No. 1 shall be grey-tinted.
 - b. Exterior pane Surface No. 2 shall be low e coated (equal to Solarcool with SolarBan 70XL).
 - 2. Interior pane: Interior pane Surface No. 3 and Surface No. 4 shall be clear (unless scheduled to be frosted or opaque).
- B. All single glazing shall be 1/4" thick (unless otherwise required by code).
- C. All exterior glazing shall be grey-tinted.
- D. All interior glazing shall be clear (unless scheduled to be frosted or opaque).

- E. All glazing in hollow metal frames, hollow metal doors, and solid wood core doors shall be with impact safety-rated Firelite Plus by Technical Glass Products.
- F. Glass shown on the drawings as not tempered shall be tempered if required by code.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Assure that openings conform to the dimensions and tolerances shown on the plans. All dimensions shall be field-verified prior to fabrication.
- B. Check that surfaces to contact windows are free of debris.
- C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Furnish and apply a sealant that is compatible with window systems to provide a completely watertight installation at all joints. Wipe off excess sealant and leave exposed surfaces and joints clean, uniform, and smooth.

3.03 CLEANING

- A. Final cleaning of all glass shall be performed by the General Contractor.

END OF SECTION

SECTION 09 22 16.13
NON-STRUCTURAL METAL STUD FRAMING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Top and bottom runners, studs, joists, internal bracing and blocking (interior and exterior).
- B. Related sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 09 29 00 – Interior Gypsum Board

1.02 REFERENCES

- A. ASTM C645 – Non-Load-Bearing Steel Studs, Runners and Rigid Furring Channels.
- B. ASTM A 446-83 – Load-Bearing Steel Studs.
- C. Gypsum Construction Handbook – 2nd Edition.
- D. GA 203 – Installation of Screw-Type Steel Framing Members to Receive Gypsum Board.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel studs shall be channel-type studs, manufacturer's standard gauge painted steel as manufactured by U.S. Gypsum Company, or equal.
- B. Interior studs shall be not less than 20 gauge at 16" o.c. Increase gauge to 18 at door jambs and heads.
- C. Interior corridor walls shall be not less than 18 gauge at 16" o.c. Increase gauge to 16 at door jambs and heads.
- D. Exterior studs shall not be less than 16 gauge at 16" o.c.
- E. Ceiling and soffit systems for gypsum board shall be not less than 18 gauge channels or joists with 7/8" 20 gauge furring channels at 16" o.c.
- F. Metal joists: Minimum of 18 gauge at 16" o.c. Align directly over metal studs when bearing on a wall assembly. Minimum of 16 gauge joists required at floor systems.
- G. Floor and ceiling runners shall be of the same materials as studs and shall be designed to secure studs in place.

- H. Approved fasteners shall be devices recommended by the stud system manufacturer in current printed instructions.
- I. Vertical deflection clips required as detailed on the drawings equal to those as manufactured by Signature Industries, the Steel Network: Verticlip SL, SLB, and SLS, Verticlip SLD, and Bridge Clip.

PART 3 - EXECUTION

3.01 ERECTION

- A. Secure top and bottom runners at 24" o.c. Align to the configuration required.
- B. Install studs vertically at 16" o.c. and not more than 2" from abutting construction, each side of openings, and at corners.
- C. Fit runners under and above openings; secure intermediate studs at spacing of wall studs.
- D. Brace stud framing system and make rigid.
- E. Coordinate erection of studs with installation of service utilities. Align stud web openings.
- F. Coordinate installation of bucks, anchors, blocking, and electrical and mechanical work to be placed in or behind stud framing.
- G. Coordinate erection of stud system with the requirements of door frame supports or attachments.
- H. Secure solid wood blocking to studs as required.
- I. Where a stud directly abuts an exterior wall, place a no. 15 asphalt felt strip between stud and wall surface.

3.02 TOLERANCES

- A. Install members to provide a surface plane with a maximum variation of $\frac{1}{8}$ " in 10' in any direction.

END OF SECTION

SECTION 09 29 00
INTERIOR GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Interior gypsum board.
 - 2. Taped and sanded joint treatment.
- B. Related sections:
 - 1. Section 06 10 00 – Rough Carpentry
 - 2. Section 09 22 16.13 – Non-Structural Metal Stud Framing
 - 3. Section 09 91 00 – Painting

1.02 REFERENCES

- A. GA 214-10 – Recommended Levels of Gypsum Board Finish
- B. GA 216 – Recommended Specifications for the Application and Finishing of Gypsum Board.
- C. GA 252 – Recommended Specifications for the Application of Gypsum Sheathing.
- D. USG – Gypsum Construction Handbook.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handle materials with care to prevent damage.
- B. Store materials inside under cover; stack flat off the floor.
- C. Store adhesives in a dry area; provide protection against freezing at all times.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD

- A. Provide gypsum board materials in accordance with the recommendations of GA 216.
- B. Paperless gypsum board: Equal to DensArmor Plus High-Performance Interior Panel by Georgia Pacific.
- C. Thickness: 5/8", Type X.

2.02 GYPSUM BOARD ACCESSORIES

- A. Provide gypsum board accessories in accordance with GA 216.
- B. Reinforcing tape, joint compound, adhesive, water, fasteners: GA 216.
- C. Corner beads: Metal.
- D. “F” molding: Gordon FD5810 or equal.
- E. “J” molding: Gordon JD-58 or equal.
- F. “R” reveal molding: Gordon RD5812 or equal.
- G. “T” molding: Gordon TD-58 or equal.
- H. Screws (ASTM C1002):
 - 1. For metal studs 20 gage – 25 gage: Equal to Grabber Bugle Head Streaker Fasteners. Black/gray phosphate.
 - 2. For metal studs 14 gage – 20 gage: Equal to Grabber Bugle Head Drivall Self Drilling. Black/gray phosphate.

PART 3 - EXECUTION

3.01 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with the recommendations of GA 216.
- B. Provide and install control joints in large continuous areas to prevent cracking.
- C. Erect single layer standard gypsum board in the direction most practical and economical, with ends and edges occurring over firm bearing.
- D. Erect single layer fire-rated gypsum board vertically, with edges and ends occurring on firm bearing.
- E. Use screws when fastening gypsum board to metal furring or framing.
- F. In locations where gypsum board abuts a dissimilar material, apply “J” mold to terminate the gypsum board and install caulking at the crack between the gypsum board and dissimilar materials.
- G. Abut gypsum board to the floor for a tight joint to avoid gaps between the wall and floor surfaces.
- H. Place corner beads at external corners. Use the longest practical lengths. Place edge trim where gypsum board abuts dissimilar materials.

- I. Tape, fill, and sand exposed joints, edges, corners, openings, and fixings to produce a surface ready to receive surface finishes. Feather coats onto adjoining surfaces so that camber is maximum 1/32".
- J. Install wall and ceiling control joints at 30' o.c. each way.
- K. Remove and re-do defective work.

3.02 CLOSING IN UNINSPECTED WORK

- A. Do not cover up or enclose work until it has been properly and completely inspected and reviewed. Should any of the work be covered up or enclosed prior to verification, uncover the work as required for inspection. Make all repairs and replacements with such materials and workmanship as are necessary at no additional cost to the Owner.

3.03 FINISHING

- A. Provide levels of gypsum finish for locations as follows in accordance with Gypsum Association GA 214-10, "Recommended Levels of Gypsum Board Finish":
 - 1. Level 1: Above lay-in ceilings and concealed areas, except provide a higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
 - 2. Level 2: At water-resistant gypsum backing board (ASTM C630) used as a substrate for tile, except remove tool marks and ridges. Provide a higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
 - 3. Level 3: At gypsum board to receive heavy or medium texture (spray-applied or hand-applied) finishes before final painting or where heavy-grade wall coverings are to be applied. Provide a higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
 - 4. Level 4: At gypsum board to receive flat paints, light textures, or wall coverings. Provide a higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
 - 5. Level 5: At all gypsum board to receive Egshell, gloss, semi-gloss, satin, or enamel paints. Spray-applied primer-surfacer, TUFF-HIDE or watered-down joint compound skim coat over the whole surface. Provide a higher level of finish as required to comply with fire resistance ratings and acoustical ratings.

END OF SECTION

SECTION 09 30 13
CERAMIC TILING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Preparation of substrate for ceramic tile installation.
- B. Furnish and install thin-set floor tile complete with incidentals.
- C. Furnish and install aluminum thresholds at the junction of tile floors with dissimilar materials.

1.02 QUALITY ASSURANCE

- A. Strictly comply with the latest edition of the Tile Council of America's *Handbook for Ceramic Tile Installation*.
- B. All the products shall conform to ANSI A137.1.
- C. Setting materials shall conform to ANSI specifications for latex-Portland cement mortar.
- D. Grouting material shall conform to ANSI specifications for latex-Portland cement grout.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with the manufacturer's instructions.

1.04 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit samples to the Architect for approval by the Owner and the Architect.
- C. Color selections by the Owner and the Architect.
- D. Submit product data on mortar, grout, and additives.

PART 2 - PRODUCTS

2.01 ACCEPTABLE TILE MANUFACTURERS

- A. Daltile.
- B. Florida Tile.
- C. Summitville.
- D. Approved equal.

2.02 FLOOR TILE

- A. TCA 137.1
- B. Equal to Daltile Keystones Mosaics Unglazed.
- C. 2" x 2" x 1/4", square-edged, non-slip, unglazed.
- D. Color to be selected by the Owner and the Architect from Group 1 or 2 price codes.
- E. Floor tile shall be a single color.

2.03 CERAMIC BASE

- A. TCA 137.1
- B. 4 1/4" x 4 1/4" x 1/4" tile with aluminum cove cap.
- C. Color to be selected by the Owner and the Architect from Group 1 or 2 price code.

2.04 INSTALLATION MATERIALS (THIN-SET METHOD)

- A. Pre-Mixed Latex Portland Cement Mortar System equal to Laticrete.
- B. Pre-Mixed Latex Portland Cement Grout System equal to Laticrete.
 - 1. Color as selected by the Owner and the Architect.
 - 2. Sanded on floors.
- C. Epoxy grout is required at bathrooms, restrooms, and wet locations.

2.05 MEMBRANE

- A. Membrane required only at floors of spaces that have tubs or showers.
- B. Equal to Hydroment, ultra-set waterproofing membrane.

2.06 ACCESSORIES

- A. Aluminum thresholds.

PART 3 - EXECUTION

3.01 INSPECTION/PREPARATION

- A. The installer must examine the substrates and the conditions upon which the ceramic tile is to be installed and must take necessary measures to correct conditions detrimental to the work. Do not proceed with the installation of ceramic tile until unsatisfactory conditions have been corrected. Initiation of tile-setting work represents acceptance of the substrate.

- B. Review and strictly follow all manufacturer's installation guidelines.

3.02 INSTALLATION

- A. Slope setting beds to drains.
- B. Cut and fit tile tight to protrusions and vertical interruptions. Form corners and bases neatly.
- C. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size. Joints: Watertight without voids, cracks, excess mortar, or grout.
- D. Allow tile to set for a minimum of forty-eight (48) hours prior to grouting.
- E. Provide and install marble thresholds at the junction with dissimilar materials.

3.03 PROTECTION

- A. Prohibit traffic from floor finish for forty-eight (48) hours after installation.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Suspended metal grid system complete with wall trim.
 - 2. 2 x 2 lay-in ceiling tiles.
- B. Related work:
 - 1. Section 07 21 00 – Thermal Insulation
 - 2. Section 09 29 00 – Interior Gypsum Board
 - 3. Division 23 – Heating, Ventilation, and Air Conditioning (HVAC)
 - 4. Division 26 – Electrical
 - 5. Division 27 – Communications
 - 6. Division 28 – Electronic Safety and Security

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit detailed product literature to the Architect for review.
- C. Submit product samples to the Architect for review.

1.03 QUALITY ASSURANCE

- A. Applicator:
 - 1. Shall be approved by the manufacturer.
 - 2. Shall have satisfactorily completed a minimum of twenty (20) installations.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Do not install acoustical ceilings until the building is enclosed, sufficient heat is provided, dust-generating activities have terminated, and overhead mechanical work is completed, tested, and approved.
- B. Permit wet work to dry prior to commencement of installation.

- C. Maintain minimum uniform temperatures of 61° F and humidity of 20% to 40% prior to, during, and after installation.

1.05 WARRANTY

- A. Ten-year limited warranty on ceiling tiles.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Armstrong.
- B. BPB (Celotex).
- C. Companies with similar experience and expertise.

2.02 SUSPENSION SYSTEM

- A. Standard interior suspension system:
 - 1. Equal to Armstrong Prelude 15/16" exposed inverted "tee" with Humiguard Plus performance.
 - 2. Conforms to ASTM C635 medium duty system.
 - 3. Grid: Exposed tee, all components die-cut and interlocking.
 - 4. Accessories: Splices, edge moldings, and hold-down clips as required to complete and complement the suspended ceiling grid system.
 - 5. Materials: 0.020 gauge commercial quality cold-rolled steel; off white enamel finish on exposed surfaces, typical.

2.03 STANDARD LAY-IN PANELS

- A. Standard acoustic tiles:
 - 1. Equal to:
 - a. "Cirrus Tegular 584" by Armstrong with Humiguard Plus Performance and BioBlock paint on front and back (inhibits mold and mildew).
 - b. "Celotex Reveal CM-454" by BPB with 104/90 Limited Warranty against sag and BioShield paint on front and back (inhibits mold and mildew).
 - 2. Mineral fiber composition.
 - 3. 24" x 24" x ¾" thick.
 - 4. Vinyl latex finish.

5. Light reflectance: 0.86.
6. UL-classified NRC 0.60, CAC 35.
7. Class A fire resistance.
8. Provide the Owner with one (1) extra package of replacement ceiling tile at project completion.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Electrical and mechanical work above the suspended ceiling must be strictly coordinated with the work of this section.

3.02 INSTALLATION

- A. Install suspended ceiling systems in accordance with the manufacturer's recommendations to produce a finished ceiling true to lines and levels and free from warped, soiled, or damaged grid or lay-in panels.
- B. Install ceiling systems in a manner capable of supporting all superimposed loads, with a maximum permissible deflection of 1/360 of span and a maximum surface deviation of 1/8" in 10'.
- C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest adjacent hangers and related carrying channels as required to span the required distance.
- E. Supply hangers or inserts for installation to the respective section in ample time and with clear instructions for their correct placement. Provide additional hangers and inserts as required.
- F. Hang independently of walls, columns, ducts, pipes, and conduit. Where carrying members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members.
- G. Center ceiling systems on the room axis, leaving equal border pieces.
- H. Do not support fixtures from or on main runners or cross runners if the weight of the fixture causes the total dead load to exceed the deflection capability. In such cases, support fixture loads by supplementary hangers located within 6" of each corner or support the fixtures independently.
- I. Do not install fixtures so that main runners and cross runners will be eccentrically loaded. Where fixture installation would produce rotation of runners, provide stabilizer bars.

- J. Install edge moldings at the intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level. Miter corners. Provide edge moldings at junctions with other ceiling finishes.
- K. Fit acoustic lay-in panels in place, free from damaged edges or other defects detrimental to appearance and function.
- L. Install lay-in panels level, in uniform place, and free from twist, warp, and dents.
- M. Prior to beginning installation, verify that the required ceiling height does not conflict with the work in place or that scheduled for execution.

3.03 ADJUSTMENTS/CLEANING

- A. Adjust any sags or twists which develop in the ceiling system and replace any part which is damaged or faulty.

END OF SECTION

SECTION 09 65 13.13
RESILIENT BASE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Preparation of substrate surfaces.
- B. Provide and install rubber base (refer to the Room Finish Schedule).
- C. Cleaning of all surfaces and areas of work.

1.02 REFERENCES

- A. FS SS-W-40 – Wall Base: Rubber and Vinyl Plastic.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Include samples of each base material and color selected.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Maintain a minimum air temperature of 70° F at the flooring installation area for three (3) days prior to, during, and for twenty-four (24) hours after installation.
- B. Store flooring materials in the area of application. Allow three (3) days for the materials to reach equal temperature as that area.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Flexco.
- B. Roppe.
- C. Johnsonite.

2.02 MATERIALS

- A. Base: Conforming to FS SS-W-40, rubber, rolled (48" pieces are allowed in special situations with the Architect's approval), 4" high, 1/8" thick including pre-molded end stops and external corners. Color as selected by the Owner and the Architect.
- B. Rubber base adhesive: As recommended by the base manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fit joints tight and vertical. Maintain minimum measurement of 18" between joints.
- B. Miter internal corners. Use pre-molded sections for external corners and exposed ends.
- C. Install base on solid backing. Adhere tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other obstructions.
- E. Install straight and level to variation of plus or minus $\frac{1}{8}$ " over 10'.
- F. Take special care to avoid glue smears on finished walls and on carpet.

END OF SECTION

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Preparation of substrate surfaces including floor patch materials to provide a uniform substrate.
- B. Provide and install vinyl composition tile (refer to the Room Finish Schedule).
- C. Provide and install transition strips.
- D. Cleaning of all surfaces and areas of work.
- E. Cleaning, stripping, and waxing of all vinyl composition tile floors.

1.02 REFERENCES

- A. FS SS-T-312 – Tile, Floor: Asphalt, Rubber, Vinyl-Asbestos.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Include samples of each flooring material, color, and pattern selected.
- C. Submit product data on stripper and wax for VCT floors.

1.04 ENVIRONMENTAL REQUIREMENTS

- A. Maintain a minimum air temperature of 70° F at the flooring installation area for three (3) days prior to, during, and for twenty-four (24) hours after installation.
- B. Store flooring materials in the area of application. Allow three (3) days for the materials to reach equal temperature as that area.
- C. The installer is required to field-verify the moisture content of the substrate and to report to the Owner and the Architect (in writing) if conditions exist which will have a negative impact on the installation of vinyl composition tile.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Armstrong.
- B. Mannington.

2.02 MATERIALS

- A. Vinyl composition tile: 12" x 12", 1/8" gauge, Armstrong Imperial texture. Colors as selected by the Owner and the Architect. All areas schedule to receive vinyl composition tile will have up to a four-color pattern.
- B. 8' x 8' water-cut bulldog logo required in the locker room floor; refer to the drawings.

2.03 ADHESIVES/SEALERS

- A. Sub-floor filler: Gray, pre-mixed, Portland-based, polymer-modified underlayment equal to Henry 345. Verify with the resilient flooring manufacturer that the sub-floor is compatible with finish flooring.
- B. Primers and adhesives: Waterproof; of types recommended by the resilient flooring manufacturer for the specific material.
- C. Flooring adhesive: Equal to products by Henry, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Ensure that floor surfaces are smooth and flat with a maximum variation of 1/8" in 10'.
- B. Ensure that concrete floors are dry and exhibit negative alkalinity, carbonization, or dusting.

3.02 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Clean that floor and apply trowel and float filler to leave a smooth, flat, hard surface. Prohibit traffic until filler is cured.

3.03 INSTALLATION

- A. The floor pattern will be provided during construction.
- B. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.
- C. Clean the substrate. Spread cement evenly in the quantity recommended by the manufacturer to ensure adhesion over the entire area of installation. Spread only enough adhesive to permit installation of flooring before initial set.
- D. Set flooring in place; press with a heavy roller to ensure full adhesion.
- E. Lay flooring with joints and seams parallel to building lines to produce a symmetrical tile pattern.

- F. Install with minimum tile width $\frac{1}{2}$ full size at room or area perimeter to the pattern as provided by the Architect.
- G. Terminate resilient flooring at the centerline of door openings where adjacent floor finish is dissimilar.
- H. Install edge strips at unprotected or exposed edges where flooring terminates.
- I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 PROTECTION

- A. Prohibit traffic from floor finish for forty-eight (48) hours after installation.

3.05 FINAL CLEANING/WAXING

- A. If VCT repairs are made in a room or space, all VCT of the room or space (new and existing VCT) shall be cleaned, stripped, waxed, and buffed.
- B. Remove excess adhesives from floor, base, and wall surfaces without damage.
- C. Strip VCT with non-acid type stripper.
- D. Apply four (4) coats of premium quality wax (25% solids) prior to installing lockers.
- E. Buff all VCT floors.

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Preparation of interior and exterior surfaces to receive paint, stain, and sealant.
- B. Prime and paint the following interior materials and items (see the Room Finish Schedule):
 - 1. All hollow metal frames.
 - 2. All gypsum board walls.
 - 3. All exposed concrete masonry units.
- C. Prime and paint the following exterior materials and items:
 - 1. All hollow metal frames and doors.
 - 2. All exposed metal fabrications.
 - 3. Traffic stripes (Alternate No. 2)
 - 4. All roof penetrations to match the color of the roof.

1.02 RELATED WORK

- A. Section 07 92 00 – Joint Sealants

1.03 QUALITY ASSURANCE

- A. Include on the label of containers:
 - 1. Manufacturer's name.
 - 2. Type of paint.
 - 3. Manufacturer's stock number.
 - 4. Color.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint materials in their sealed, original, labeled containers bearing the manufacturer's name, type of paint, brand name, color designation, and instructions for mixing and/or reducing.
- B. Provide adequate storage facilities. Store paint materials at a minimum ambient temperature of 45° F in a well ventilated area.

- C. Take precautionary measures to prevent fire hazards and spontaneous combustions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Sherwin Williams.
- B. Devoe.
- C. Benjamin Moore.
- D. Pittsburgh Paint.
- E. Farrell Calhoun.
- F. Prosoco.
- G. Approved equal.

2.02 MATERIALS

- A. Paint, varnish, stain, enamel, and fillers: Type and blend listed herein or equivalent products approved by the Architect. The prime/paint schedule is based upon the products of Sherwin Williams.
- B. Paints: Ready-mixed, field-catalyzed coatings. Pigments fully ground maintain a soft paste consistency, capable of readily and uniformly dispersing to a completely homogeneous mixture.
- C. Paints are to have good flowing and brushing properties and are to be capable of drying or curing free of streaks or sags.

2.03 COLORS

- A. Colors of paints and stains shall be as selected by the Owner and the Architect.

2.04 MIXING AND TINTING

- A. Deliver all paints ready-mixed to the job site.
- B. Accomplish job-mixing and job-tinting only when doing so is acceptable to the Architect.
- C. Mix only in mixing pails in suitably sized non-ferrous or oxide-resistant metal pans.
- D. Use tinting colors recommended by the manufacturer for the specific type of finish.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Thoroughly examine the surfaces scheduled to be painted or stained prior to commencement of the work. Report in writing to the Architect any condition that may potentially affect proper application. Do not commence until such defects have been corrected. Initiation of painting and staining work indicates acceptance of the substrate condition.
- B. Correct defects and deficiencies in surfaces which may adversely affect the work of this section.

3.02 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply finishes unless moisture contents of surfaces are below the following maximums:
 - 1. Gypsum wallboards: 12%.
 - 2. Masonry, concrete, and concrete block: 12%.
 - 3. Interior located wood: 15%.
- B. Temperature requirements:
 - 1. Ensure that the surface temperature or the surrounding air temperature is above 40° F before applying finishes.
 - 2. Minimum application temperatures:
 - a. Latex paints: 45° F for interior work and 50° F for exterior work.
 - b. Varnish finishes: 65° F.
 - 3. Provide adequate continuous ventilation and sufficient heating facilities to maintain temperatures above 45° F for twenty-four (24) hours before, during, and for forty-eight (48) hours after application of finishes.
- C. Provide minimum 25-foot candles of lighting on surfaces to be finished.
- D. Comply with the manufacturer's recommendations as to the environmental conditions under which coatings and coating systems can be applied.
- E. Do not apply finish in areas where dust is being generated.
- F. Allow asphaltic paving to cure fourteen (14) days minimum before applying traffic stripes.

3.03 PROTECTION

- A. Adequately protect other surfaces from paint and damage. Repair damage as a result of inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and, in particular, those surfaces within the storage and preparation area.
- C. Place cotton waste, cloth, and material which may constitute a fire hazard in closed metal containers and remove daily from the site.
- D. Remove electrical plates, surface hardware, fittings, and fastenings prior to painting operations. These items are to be carefully stored, cleaned, and replaced upon completion of work in each area. Do not use solvents to clean hardware that may remove permanent lacquer finish.
- E. Painting is not required on any of the following unless specifically called for elsewhere in the Contract Documents:
 - 1. Acoustical materials.
 - 2. Stainless steel, copper, or anodized aluminum.
 - 3. Aluminum window/door frames and aluminum doors.
 - 4. Pre-finished wood doors.
 - 5. Metal roof panels, flashing, and gutters/downspouts.
 - 6. Concealed pipes, ductwork, and equipment.
 - 7. Factory-finished doors and frames.
 - 8. Factory-finished shelves, cabinets, and similar material.

3.04 PREPARATION

- A. Ferrous metal:
 - 1. Remove all rust and mill scale from surfaces requiring an exposed finish coat of paint.
 - 2. Prior to blast-cleaning, contamination shall be removed from steel surfaces. Remove oil and grease by solvent-cleaning.
 - 3. Prepare ferrous metal surfaces in strict accordance with the rust-inhibitive primer manufacturer's instructions.
 - 4. Wash unprimed galvanized metal with a solution of chemical phosphoric metal etch and allow to dry completely.

5. Sand and scrape shop-primed steel surfaces to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

B. Galvanized metals:

1. Galvanized steel surfaces requiring painting must be solvent-cleaned to remove all traces of grease or oil before priming as per specification.
2. Etching type primer is required.

C. New gypsum board:

1. New gypsum board must be free of sanding dust and joint treatment cement must be thoroughly dry.
2. Steel corner beadings should be primed with an appropriate metal primer before applying latex coatings.

D. Concrete masonry units:

1. At concrete masonry units, remove mortar and other foreign matter.
2. Fill large voids; caulk joints and cracks. Repair mortar as required.
3. Blow dust off materials with compressed air.
4. Check moisture content with a moisture meter before initiating priming/painting work.

3.05 SCAFFOLDS, LADDERS, AND PROTECTION

- A. The Contractor must furnish all required ladders, stages, scaffolds, etc., and they must be in safe condition, having adequate strength to support the maximum work load and complying with all current OSHA regulations.
- B. Scaffolds, ladders, etc., must not be left where they would interfere with other workmen, when not in daily use.
- C. The Contractor must not only protect his work, but also that of other trades.
- D. The Contractor is responsible for removal of all paint or coating splatter, spills, etc., on floors or adjacent colors, material, glass, hardware, and other finished surfaces.
- E. The Contractor must leave the premises clean and free from all rubbish and accumulated materials left from his work.

3.06 APPLICATION

- A. Do not apply initial coating (primer) until the moisture contents of surfaces are within limitations recommended by the paint manufacturer.

- B. Apply primer and paint with suitable brushes or rollers.
 - 1. The rate of application shall not exceed that as recommended by the paint manufacturer for the surface involved less 10% allowance for loss.
 - 2. Keep brushes, rollers, and spraying equipment clean, dry, free from contaminates, and suitable for the finish required.
 - 3. Apply primer and paint by brush or roller.
- C. Comply with the recommendations of the product manufacturer for drying time between coats.
- D. Sand and dust between each coat to remove defects visible from a distance of 6'.
- E. Finish coats shall be smooth and free of brush marks, streaks, laps or pile-up of paints, and skipped or missed areas.
- F. Finished metal surfaces shall be free of skips, voids, or pinholes.
- G. Leave all parts of molding and ornaments clean and true to details with no undue amount of paint in corners and depressions.
- H. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
- I. Refinish the whole wall, if necessary, where any portion of the finish has been damaged or is not acceptable.
- J. Back-prime any new exterior woodwork with house paint primer prior to installation. Runs on the face are not permitted.
- K. Spot-painting to correct soiled or damaged paint surfaces will be allowed only when touch-up is blended into the surrounding finish and is invisible to normal viewing. Otherwise, re-coat the entire section to corners or visible stopping point.
- L. **Prime the top and bottom edges of wood and metal doors with an enamel undercoat when they are to be painted.**
- M. **Prime the top and bottom edges of wood and metal doors with a gloss varnish when they are to receive a stain or clear finish.**
- N. When paint, stain, or coating is roller-applied, proper skill must be used to avoid all signs of lapping and excess paint lines from the edge of the roller. When cutting in with a brush is required, these areas must be of the same texture, color, and hiding as adjacent areas to assure a good appearance.
- O. All metal surfaces scheduled to be painted shall be washed with mineral spirits to remove dirt, oil, or grease prior to painting.
- P. Approximately 25% of walls will require accent colors in saturated color. These walls may require an additional coat of paint for coverage.

3.07 CLEANING

- A. Touch up and restore finish where damaged.
- B. Remove spilled, splashed, or splattered paint from all surfaces.
- C. Leave the storage area clean. Remove from the site any and all empty paint containers and debris from painting operations.

3.08 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Refer to mechanical and electrical sections with respect to painting and finishing requirements.
- B. Remove grilles, covers, and access panels for mechanical and electrical systems from location and paint separately.
- C. Finish-paint primed equipment to the color selected.
- D. Where exposed, prime and paint insulated and bare pipes, conduits, boxes, insulated and bare duct, hangers, brackets, collars, and supports except where items are plated or are covered with a pre-finished coating.
- E. Replace identification markings on mechanical or electrical equipment when painted over or splattered.
- F. Paint both sides of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

3.09 PRIME/PAINT SCHEDULE

Note: The Schedule is written upon the products of Sherwin Williams. All finishing requirements are based on and shall be a two-coat, three-coat, or four-coat system.

- A. Exterior surfaces:
 - 1. Ferrous metal (iron and steel):
 - 1 coat Kem Bond HS Universal Primer
 - OR
 - 1 coat DTM Acrylic Primer/Finnish
 - 2 coats A-100 Exterior Latex Flat/Satin or Gloss
 - 2. Galvanized iron:
 - 1 coat Galvite HS @ 3.0 – 4.5 mils dft/ct
 - 2 coats DTM Acrylic Coating @ 2.5 – 4.0 mils dft/ct
 - or
 - 2 coats Metalatex Semi-Gloss Enamel

3. Metal doors and frames:
 - 1 coat Kem Kromik Universal Metal Primer
 - 2 coats Industrial Semi-Gloss Enamel
4. Traffic stripes (Alternate No. 2):
 - 2 coats yellow or white traffic paint
 - 2 coats H.C. blue at H.C. areas

B. Interior surfaces:

1. Gypsum board (semi-gloss):
 - 1 coat PrepRite 200 High Build Interior Latex Primer/Surfacer B28W601
 - 2 coats ProMar 200 Interior Latex Semi-Gloss Paint
2. Concrete block (Eggshell):
 - 2 coats minimum ProMar Interior Exterior Block Filler (as required to fill the surface with a solid coat of filler which penetrates holes, surface imperfections, etc., and seals the surface prior to the application of paint. The Architect shall approve the block filler application prior to application of the paint finish)
 - 2 coats ProMar 200 Interior Latex Eggshell
3. Concrete block (epoxy) at all restroom walls:
 - 2 coats minimum ProMar Interior Exterior Block Filler (as required to fill the surface with a solid coat of filler which penetrates holes, surface imperfections, etc., and seals the surface prior to the application of paint. The Architect shall approve the block filler application prior to application of the paint finish)
 - 2 coats Water-Based Catalyzed Epoxy
 - OR
 - 2 coats Sher-Tile HS Epoxy
4. Metal doors, windows, and frames:
 - 1 coat Kem Kromik Universal Metal Primer
 - 2 coats Alkyd Semi-Gloss Enamel

END OF SECTION

SECTION 10 14 13

INTERIOR SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Engraved name and number plates at all spaces as scheduled on the Door Schedule.

1.02 REFERENCES

- A. ADA – Americans with Disabilities Act, Accessibility Guidelines.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the manufacturer's product data and installation instructions.
- C. Color to be selected by the Owner and the Architect.
- D. Submit a schedule of signage to the Architect for approval by the Owner and the Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. See Touch Graphics, Inc., RP 100.
- B. Mohawk Sign Systems, 200A-Type D.
- C. ASI Sign Systems, Intouch.
- D. Supersine, Acrylic.
- E. Or approved equal.

2.02 COMPONENTS

- A. Minimum size:
 - 1. Type 1: 6" x 8" (without changeable message, ADA).
 - 2. Type 2: 6" x 8" (without changeable message, standard).
 - 3. Type 3: 6" x 8" (with changeable message, standard).
 - 4. Type 4: 8" x 4" (without changeable message).
- B. Character proportions: Letters and numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke width-to-height ratio between 1:5 and 1:10.

- C. Finish and contrast: Characters and symbols shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background. Material: Plastic laminate or acrylic.
- D. Raised and Braille characters and pictorial symbol signs: Letters and numbers on signs shall be raised 1/32" (0.8 mm) minimum, upper case, Sans Serif type characters, and shall be accompanied with Grade 2 Braille. Raised characters or symbols shall be at least 5/8" (16 mm) high, but no higher than 2" (50 mm). Pictograms shall be accompanied by the equivalent verbal description placed directly below the pictogram. The border dimension of the pictogram field shall be 6" (152 mm) minimum in height. Characters and Braille shall not be located in the pictogram field.
- E. Symbols of accessibility: Facilities and elements required to be identified as accessible shall use the international symbols of accessibility.
- F. Changeable signage: Provide changeable message capability as scheduled.
- G. Braille: All Braille located on interior signage shall be contracted (Grade 2).
 - 1. Braille dots shall have a domed or rounded shape.
 - 2. Braille shall be positioned below the corresponding text. If text is multi-lined, Braille shall be placed below the entire text. Braille shall be separated 3/8" (9.5 mm) minimum from any other tactile character and 3/8" (9.5 mm) minimum from raised borders and decorative elements.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mounting location and height: Interior signage shall be installed on the wall adjacent to the latch side of the door; where there is no wall space to the latch side of the door, including double-leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60" above the finish floor to the center line of the sign and located 9" from the door jamb frame to the center line of the sign. Mounting location for such signage shall be so that a person may approach within 3" of the signage without encountering protruding objects or standing within the swing of the door.
- B. **Do not mount signage directly to doors or frames.**
- C. Mount with double-faced foam tape and clear silicone.

3.02 SIGNAGE SCHEDULE

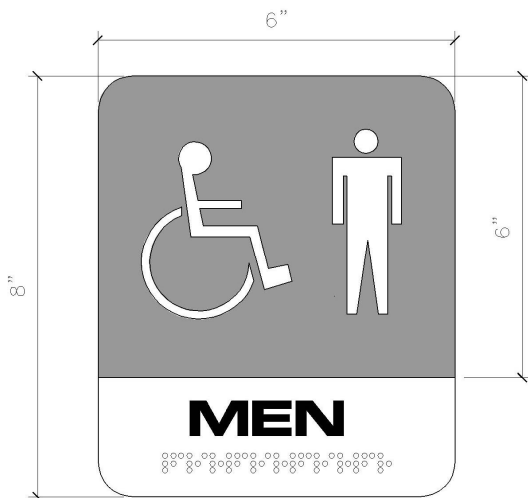
- A. Minimal signage required:
 - 1. At restrooms: ADA symbol and appropriate gender symbol (or symbols for unisex restrooms).
 - 2. Any additional signage required by the Americans with Disabilities Act or local building codes.

B. Refer to the Door Schedule for complete signage requirements.

PART 4 - FIGURES

4.01 SIGNAGE TYPE

A. Type 1: 6" x 8" (without changeable message, ADA)



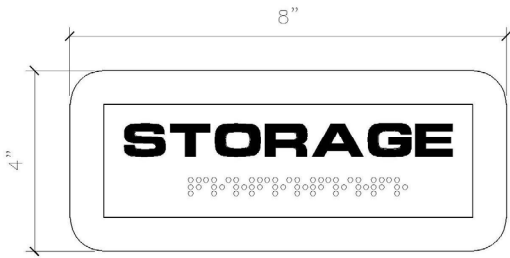
B. Type 2: 6" x 8" (without changeable message, standard)



C. Type 3: 6" x 8" (with changeable message, standard)



D. Type 4: 8" x 4" (without changeable message)



4.02 INTERNATIONAL SYMBOLS FOR ACCESSIBILITY



Proportions (A)



Display Conditions (B)

END OF SECTION

SECTION 10 14 16
PLAQUES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install a project identification plaque.

1.02 SHOP DRAWINGS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Provide shop drawings to the Architect for approval by the Owner and the Architect.
- C. Provide finish samples to the Architect for approval by the Owner and the Architect.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Leeds.
- B. Matthews.
- C. Southwell Co.
- D. Or equal.

2.02 CONSTRUCTION

- A. Material: Cast bronze.
- B. Size: 24" W x 36" H.
- C. Letter style: Times Roman.
- D. Border style: Single line.
- E. Background texture: Leatherette.
- F. Mounting: Rosettes (verify the surface to be mounted on)
- G. Background color: Natural sandblast bronze.

2.03 CONTENT

- A. Sign shall contain:
 - 1. Name of the project.
 - 2. Name of the Owner.

3. Name of the Superintendent.
4. Names of Board Members.
5. Year the construction was completed.
6. Name of the Project Architect.
7. Name of the Contractor.

2.04 PLAQUES IN PUBLIC BUILDINGS

- A. Plaques in public buildings paid for with public funds shall acknowledge the contribution of taxpayers.
- B. Include the following text on plaques in public buildings:
 1. This building was paid for by the taxpayers of the State of Mississippi.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install where directed by the Owner and the Architect.

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Restroom accessories and attachment hardware in all restrooms.
- B. Related sections:
 - 1. Section 06 10 00 – Rough Carpentry (solid blocking)

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the manufacturer's product data for any substitutions for the Architect's review.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver accessories to the site until the rooms in which they are to be installed are ready to receive them.
- B. Pack accessories individually in a manner to protect each accessory and its finish.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Bradley (for description purposes, model numbers included for restroom accessories are items manufactured by Bradley).
- B. Bobrick.
- C. ASI Group.

2.02 PRODUCTS

- A. Grab bar:
 - 1. 18" ADA-compliant grab bar: Equal to Bradley series 812, 18 gage 304 stainless steel tubing, 1½" diameter, safety grip finish, concealed mounting. Mount 34" above the finished floor. One (1) is required at each handicap accessible toilet.
 - 2. 36" ADA-compliant grab bar: Equal to Bradley series 812, 18 gage 304 stainless steel tubing, 1½" diameter, safety grip finish, concealed mounting. Mount 34" above the finished floor. One (1) is required at each handicap accessible toilet.

- 3. 42" ADA-compliant grab bar: Equal to Bradley series 812, 18 gage 304 stainless steel tubing, 1½" diameter, safety grip finish, concealed mounting. Mount 34" above the finished floor. One (1) is required at each handicap accessible toilet.
- B. Mop and broom holder: Model 9954.
- C. Mirrors: 24" wide x 36" high, Model 780-2436.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Provide solid blocking as required for mounting accessories.
- B. Before starting work, notify the Architect of any conflicts detrimental to installation or operation of accessories.

3.02 INSTALLATION

- A. Install accessories with attachment hardware as provided by the accessory manufacturer and in strict accordance with the manufacturer's instructions.
- B. Install accessories plumb and level, securely anchored to the substrate.

3.03 PROTECTION

- A. Protect adjacent or adjoining finished surfaces and work from damages during installation of the work.

END OF SECTION

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Furnish and install one (1) fire extinguisher and cabinet at each exit and as shown on the drawings.
2. Furnish, install, and maintain construction phase fire extinguishers throughout the construction of the project; comply with applicable codes and jurisdictional requirements.

B. Related sections:

1. Section 06 10 00 – Rough Carpentry
2. Section 09 22 16.13 – Non-Structural Metal Stud Framing
3. Section 09 29 00 – Interior Gypsum Board

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the manufacturer's operation and maintenance data.
- C. Include test, refill or recharge schedules, procedures, and re-certification requirements.

1.03 QUALITY ASSURANCE

- A. Conform to NFPA-10, Standard for Portable Fire Extinguishers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Potter-Roemer, Inc.
- B. J.L. Industries.
- C. Larsen's.
- D. Or equal.

2.02 FIRE EXTINGUISHERS

- A. General purpose for light and ordinary hazard locations:

1. Ten-pound.
2. Type 2A-80B:C UL rating.
3. Equal to Larsen's MP10.

2.03 FIRE EXTINGUISHER CABINETS

A. General requirements:

1. Aluminum construction.
2. Semi-recessed mounted.
3. Rolled radius frame.
4. Full view panel with text denoting "Fire Extinguisher".
5. Size cabinets appropriately for the extinguisher housed.
6. Cabinets shall comply with ADA requirements and shall protrude no more than 4" from the wall.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Do not install extinguishers when ambient temperatures may cause freezing.
- B. Verify that cabinets are correctly sized and located.
- C. Beginning of installation indicates acceptance of the existing conditions.

3.02 INSTALLATION

- A. Install cabinets plumb and level 48" from the finished floor to the cabinet handle or as shown on the drawings.
- B. Secure rigidly in place in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 10 81 50
PROTECTIVE PLUMBING INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install flexible vinyl insulation on plumbing traps, supplies, and stops beneath all lavatories, sinks, and countertops which are exposed and subject to contact.

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the manufacturer's product data for the Architect's review.

1.03 COMPLIANCE

- A. Satisfy ADA Article 4.19.4, and ANSI A117.1.

PART 2 - PRODUCTS

2.01 COMPONENTS

- A. Pre-manufactured flexible vinyl components to completely cover all exposed pipes, fittings, and valves.

2.02 MANUFACTURERS

- A. Equal to "Handi Lav-Guard" by Truebro, Inc., or Brocar Products, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install components in strict accordance with the manufacturer's written instructions.

END OF SECTION

SECTION 12 21 00
WINDOW BLINDS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Horizontal louver window blinds.

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the manufacturer's descriptive literature and instructions for installation.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store manufactured products in their original, unopened packaging. Stored materials shall be kept under cover in a dry place to prevent damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Bali.
- B. Levelor.
- C. Approved equal.

2.02 MATERIALS

- A. 1" aluminum blinds (slat size: .984").
- B. Slat thickness: .006" (standard) or .008" (option) aluminum.
- C. Head size: 1" x 1½" wide.
- D. Color as selected by the Owner and the Architect.
- E. Provide blinds in widths corresponding to the vertical mullion spacing of windows. Where these smaller sections of blinds are ganged together, provide a continuous valance of the longest possible width to cover the heads.
- F. Provide a continuous valance at all blinds.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install blinds in compliance with the manufacturer's written instructions.

- B. Verify opening sizes on site.

END OF SECTION

SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Furnish all labor, materials, and engineering services required to complete the roof, framing system, including anchor bolts, columns, beams, girts, bracing, mounting accessories, roof insulation, wall panels, metal trim, downspouts, gutters, insulation, and other components required for a complete job.
- B. Anchor bolts, an anchor bolt setting plan, and anchor bolt templates shall be provided by the metal building system contractor. Anchor bolts shall be of sufficient length to extend to the bottom of the mat of reinforcing steel.
- C. Metal building manufacturers are cautioned that these are masonry buildings. The design shall limit drift at 10'-0" AFF to H/360, but in no case shall drift at 10'-0" AFF exceed $\frac{3}{8}$ ". There will be no exceptions to this arrangement.
- D. The metal building supplier shall design the structural system with close attention to the detailing of the architectural drawings. Columns typically fall within CMU enclosures; therefore, columns shall be sized to fall within enclosure dimensions where possible.

1.02 CODES AND STANDARDS

- A. Refer to the structural drawings.

1.03 WARRANTIES

- A. Weathertightness: A manufacturer's representative shall inspect the installation of the roofing system and, upon approval, shall furnish a twenty-year, no-dollar-limit (NDL) roofing system warranty for weathertightness. This warranty is to provide up to one (1) full replacement of the roof, including material and labor. The warranty shall include all roofing components consisting of, but not limited to, roof panels, anchoring devices, metal flashing, gutters, roof penetration flashing, roof curbs, plumbing vent flashing, and all other roof items furnished by or approved by the metal roof manufacturer.
- B. Twenty-year wall paint warranty as follows:
 - 1. Will not chalk (gradual erosion of film) in excess of ASTM D659 Number 8 rating for a period of twenty (20) years from the date of shipment as determined by procedures outlined in ASTM D659.
 - 2. Will not fade (color change of file) in excess of 5NBS units when measured in accordance with the standard procedure specified in ASTM D2244-94 for a period of twenty (20) years.
 - 3. Will not noticeably crack, check-blister, or peel for a period of twenty (20) years.

- C. The Contractor shall provide a written guarantee agreeing to maintain the roof free of leaks for a period of two (2) years starting upon the date of substantial completion.
- D. All warranties shall be in the name of the Contractual “Owner” as listed in the Owner-Contractor Agreement for this project. The Contractor (General Contractor or Subcontractor) shall not be listed as the “Owner” on any warranties.

1.04 DRAWINGS AND CALCULATIONS

- A. The Contractor shall provide erection information and drawings as required to describe and define the system. Drawings shall include an anchor bolt setting plan and piece marks or all major parts for easy field-identification.
- B. Submit a letter of design certification for the structural framing and covering the panels of the metal building system. This letter of certification is to be signed and sealed by a registered professional engineer licensed in the State of Mississippi.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. CECO.
- B. Kirby Building Systems.
- C. Or equal.

2.02 PRIMARY MEMBERS

- A. Members fabricated from plate, plate coils, strip mill plate, or flat bar stock shall have flanges and webs joined on one side of the web by a continuous welding process. Minimum yield strength: 50,000 psi.
- B. Members fabricated from W shapes shall conform to the physical specification of ASTM A529. Minimum yield strength: 42,000 psi.
- C. Primary frames may not exceed 24" depth up to 9'-0" AFF.
- D. Portal frames may not exceed 16" depth.

2.03 SECONDARY MEMBERS

- A. Purlins, girts, and eave struts shall be cold formed from steel which has a minimum yield strength of 55,000 psi.
- B. Purlins shall be “Z” sections.
- C. Girts shall be “Z” sections or break formed “C” sections.
- D. Eave struts shall be “C” sections.

2.04 STRUCTURAL STEEL PRIMING

- A. Clean and prepare all steel members in accordance with the latest issue of SSPC (Society for Protective Coating) guidelines, as a minimum.
- B. Prime steel members:
 - 1. Minimum one mil thickness.
 - 2. Primer shall be equal to SSPC No. 15, Type 1, red oxide.

2.05 BRACING

- A. Transverse wind/seismic forces shall be transferred to the foundation through the use of portal bracing at walls in combination with “X” bracing in the plane of the roof.

2.06 STRUCTURAL BOLTS/NUTS

- A. ASTM A325.

2.07 ROOF PANELS

- A. Standing seam panels of roll-formed 24 gauge steel seamed on site with a mechanical seamer.
- B. Panel coverage: 24".
- C. Major ribs: Taper from 1" at the top to 4½" at the base.
- D. Configurations: Interlocking standing legs at side laps which are field-seamed together in to a double-fold, lock joint by use of a mechanical seamer, for a full Pittsburgh roll seam. Factory-applied sealant shall be provided in the overlapping standing seam leg.
- E. Fasteners: Concealed clips seamed into panel side laps. Screws for clips, self-tapping, length as required.
- F. Equal to Double-Lok by CECO. Kynar 500 finish over galvalume (or equal) substrate. Color as selected by the Owner and the Architect from standard colors.

2.08 WALL PANELS

- A. Roll-formed from 50,000 psi yield steel in 26 gauge.
- B. Panel coverage: 36".
- C. Ribs: 1¼" deep major ribs at 12" centers.
- D. Equal to PBR Panel by CECO. Signature 300 finish over galvalume (or equal) substrate. Color as selected by the Owner and the Architect from standard colors.

2.09 FLASHING AND TRIM

- A. 26 gauge prefinished metal.
- B. Color as selected by the Owner and the Architect from standard colors.

2.10 GUTTERS AND DOWNSPOUTS

- A. 26 gauge prefinished metal.
- B. Continuous gutter of manufacturer's standard profile as indicated on drawings. 6" width x 8" height standard.
- C. Downspouts as indicated on the drawings; manufacturer's standard profile.
- D. 5¼" width x 3-11/16" depth standard.
- E. Color as selected by the Owner and the Architect from standard colors.

2.11 INSULATION

- A. Provide Bay Insulation System, Skyliner Insulation System, with minimum R-30 with white fabric liner system and white painted steel support straps at the roof.
- B. Wall insulation is to be fiberglass, R-19, laminated to 3.2 mil vinyl.

2.12 ROOF PENETRATIONS

- A. Notify the Architect prior to installation of any penetrations.
- B. Verify type and size of all roof penetrations with Divisions 21, 22, 23, and 26.
- C. All roof penetrations shall be made and installed by the metal building systems contractor.
- D. Round pipe, plumbing stacks, electrical conduits, and flue pipes shall be flashed with EPDM or neoprene compression molded rubber with 1" wide corrosion-resistant flexible aluminum base. The base flange shall be incorporated with a pleated expansion joint. Set in sealant and use non-corrosive fasteners.
 - 1. The metal building systems contractor shall coordinate with other trades and provide and install flashing for each condition encountered.
 - 2. Install flashing in the flat portion of the panels or through ribs with approval. Consult the Architect if penetration size exceeds the spacing of ribs.
 - 3. Install so as not to block the flow of water.
 - 4. Review each proposed penetration detail with the Architect prior to cutting the roof.
 - 5. Flashing shall be equal to Deck-Mate by Portals Plus or Dektite.

- E. Curbs: Attic fans, exhaust fans, and mechanical equipment shall be installed on pre-manufactured 24 gauge aluminum-zinc alloy curbs. Color and finish shall match roof panels.
 - 1. The metal building systems manufacturer shall coordinate with other trades to determine each condition which will be encountered.
 - 2. Curbs shall be furnished by the trade which is providing and installing the equipment. Curb shall be installed by the metal building systems contractor.
 - 3. Curbs shall be installed under the roof panels on the up-slope end and over the panels at the down-slope end.
 - 4. Provide additional sub-framing at areas receiving curbs. Install with triple bead tape sealer, sealant, and cinch straps.
 - 5. Review each proposed penetration detail with the Architect prior to cutting the roof.
 - 6. Curbs shall be equal to custom curbs or LM curbs.

2.13 SEALANTS

- A. Sealants for side laps, end laps, accessories, etc., shall be a preformed, butyl rubber-based compound. The material shall be non-hardening, non-shrinking, and non-corrosive and shall have excellent adhesion to metals, painted surfaces, and plastics to temperatures from –30° F to 160° F. These sealants shall be in tape mastic form, shall be of shape and size recommended by the manufacturer of the metal building for various applications, and shall have paper backing for easy handling.
- B. Tube sealants shall be used to supplement tape mastic sealants and shall be applied in locations indicated by erection instructions. Tube sealant shall be a synthetic, elastomeric-based material which becomes tack-free in less than two (2) hours at 75° F but retains flexibility.

PART 3 - EXECUTION

3.01 ERECTION

- A. Erection shall be in accordance with the appropriate erection drawings and guides by the metal building systems manufacturer.
- B. It is the responsibility of the erector to comply with all appropriate legal and safety requirements. It is the responsibility of the erector to determine and provide any and all temporary bracing, shoring, blocking, bridging, and/or securing of components.
- C. Take special care to coordinate the work of this section with the following work sections:
 - 1. Section 03 30 00 – Cast-In-Place Concrete. Furnish and install anchor bolts, an anchor bolt setting plan, and anchor bolt templates for the mounting of primary framing elements.

- D. The metal building systems contractor shall remove from the site all trash and debris that results from the operations of this category of work.

END OF SECTION

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SECTION 22 05 15
BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Mechanical demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 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 manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:

- a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Available Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Available Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM 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. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Under-deck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. 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.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. 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 with spring clips.
 - 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, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - i. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- T. Verify final equipment locations for roughing-in.

- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 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.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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 unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Non-pressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.

- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Copper-alloy ball valves.
 - 2. Ferrous-alloy butterfly valves.
 - 3. Bronze check valves.
 - 4. Gray-iron swing check valves.
 - 5. Cast-iron plug valves.
- B. Related Sections include the following:
 - 1. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PTFE: Polytetrafluoroethylene plastic.
 - 5. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
 - 1. Exceptions: Domestic hot- and cold-water, sanitary waste, and storm drainage piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 - 1. Handwheel: For valves other than quarter-turn types.
 - 2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
 - 3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
 - 2. Threaded: With threads according to ASME B1.20.1.
- I. Valve Bypass and Drain Connections: MSS SP-45.

2.3 COPPER-ALLOY BALL VALVES

- A. Manufacturers:
 - 1. Two-Piece, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Hammond Valve.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.

- i. Red-White Valve Corp.
 - j. Watts Industries, Inc.; Water Products Div.
- B. Copper-Alloy Ball Valves, General: MSS SP-110.
- C. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

2.4 FERROUS-ALLOY BUTTERFLY VALVES

- A. Manufacturers:
 - 1. Crane Co.; Crane Valve Group; Center Line.
 - 2. Crane Co.; Crane Valve Group; Stockham Div.
 - 3. General Signal; DeZurik Unit.
 - 4. Grinnell Corporation.
 - 5. Hammond Valve.
 - 6. Metraflex Co.
 - 7. Milwaukee Valve Company.
 - 8. Mueller Steam Specialty.
 - 9. NIBCO INC.
 - 10. Red-White Valve Corp.
 - 11. Watts Industries, Inc.; Water Products Div.
- B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
- C. Flangeless, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one or two piece stem.
- D. Single-Flange, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.
- E. Flanged, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one or two piece stem.

2.5 BRONZE CHECK VALVES

- A. Manufacturers:
 - 1. Type 3, Bronze, Swing Check Valves with Metal Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Hammond Valve.

- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Red-White Valve Corp.
- j. Watts Industries, Inc.; Water Products Div.

- B. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.
- C. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.

2.6 GRAY-IRON SWING CHECK VALVES

A. Manufacturers:

- 1. Cincinnati Valve Co
- 2. Crane Co.; Crane Valve Group; Crane Valves.
- 3. Crane Co.; Crane Valve Group; Jenkins Valves.
- 4. Crane Co.; Crane Valve Group; Stockham Div.
- 5. Grinnell Corporation.
- 6. Hammond Valve.
- 7. Milwaukee Valve Company.
- 8. Mueller Co.
- 9. NIBCO INC.
- 10. Red-White Valve Corp.
- 11. Watts Industries, Inc.; Water Products Div.

- B. Type I, Class 250, gray-iron, swing check valves with metal seats.

2.7 CAST-IRON PLUG VALVES

A. Manufacturers:

- 1. Non-lubricated-Type, Cast-Iron Plug Valves:
 - a. General Signal; DeZurik Unit.
 - b. Grinnell Corporation.
 - c. Mueller Flow Technologies.
 - d. Wheatley Gaso, Inc.

- B. Class 125 or 150, non-lubricated-type, cast-iron plug valves.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly or gate valves. Use ball on 3" and smaller.
 - 2. Throttling Service: Ball or butterfly valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same with higher SWP class or CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2 and Smaller Two piece, 400-psig CWP rating, copper alloy.
 - 2. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.
 - 3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125 bronze.
 - 4. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125 gray iron.

3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 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.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing piping Insulation" for insulation.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 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. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - l. Piping Technology & Products, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.
 - c. GS Metals Corp.
 - d. Michigan Hanger Co., Inc.; O-Strut Div.

- e. National Pipe Hanger Corp.
 - f. Thomas & Betts Corp.
 - g. Unistrut Corp.
 - h. Wesanco, Inc.
3. Thermal-Hanger Shield Inserts:
- a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.
 - e. Rilco Manufacturing Co., Inc.
 - f. Value Engineered Products, Inc.
4. Powder-Actuated Fastener Systems:
- a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
- 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
- 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
- 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
 - 3. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
6. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
9. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. 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.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. 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.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. 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.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate

or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.
- E. Install powder-actuated drive-pin fasteners 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.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- 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. 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 so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. Insulated Piping: Comply with the following:
 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 according to ASME B31.9.
 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 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 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.

4. 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.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 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 contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: 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. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Restrained spring isolators.
 - 5. Housed spring mounts.
 - 6. Elastomeric hangers.
 - 7. Spring hangers with vertical-limit stops.
 - 8. Pipe riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Restrained air-mounting system.
 - 11. Seismic snubbers.
 - 12. Restraining braces and cables.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 119 MPH
 - 2. Building Category: Enclosed.

3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the plumbing component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Seismic Design Category as Defined in the IBC: D.
 - a. *Component* Importance Factor: 1.5.
 - b. Component Response Modification Factor: Per Table 13.6-1 of ASCE 7-10 “Minimum Design Loads for Buildings and Other Structures.”
 - c. Component Amplification Factor: Per Table 13.6-1 of ASCE 7-10 “Minimum Design Loads for Buildings and Other Structures.”
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 50.0%.
4. Design Spectral Response Acceleration at 1.0-Second Period: 30.0%.

C. SUBMITTALS

D. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. 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 OSHPD.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

A. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Certification documents to be signed and sealed by a qualified Professional Engineer with at least 5 years experience in the design of seismic restraints.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure,

- spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
 4. 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. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- B. Coordination Drawings: Show coordination of seismic bracing for mechanical piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- C. Equipment Manufacturer Seismic Qualification Certification: The Equipment Manufacturer must submit certification that each piece of provided equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether the "withstand" certification is based on actual test of assembled components or on calculations.
 - a. Indicate the equipment is certified to be durable enough to structurally resist the design forces and will also remain functional after the seismic event.
- D. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- E. Welding certificates.
- F. Qualification Data: For professional engineer and testing agency.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by OSHPD. 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) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.6 WORK FURNISHED BUT NOT INSTALLED

- A. The materials and systems specified in this section shall be purchased by the mechanical contractor from a single seismic snubber restraint materials manufacturer to assure sole source responsibility for the performance of the seismic restraints used.
- B. The materials and systems specified in this section can, at the contractor's option, be installed by the subcontractor who installs the mechanical equipment, piping, or ductwork.

1.7 COORDINATION

- A. Coordinate size, shape, reinforcement and locate cast in place anchor-bolt inserts for concrete Inertia bases. 3000 psi min Concrete and/or formwork as needed is provided by others.

1.8 DESCRIPTION OF SYSTEM

- A. It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and mechanical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.
- B. The work under this section shall include furnishing all labor, materials, tools, appliances, and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications

1.9 SYSTEM DESIGN

- A. Seismic snubber manufacturer shall be responsible for the structural design of attachment hardware as required to attach snubbers to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.
- B. The contractor shall furnish a complete set of approved shop drawings of all mechanical equipment which is to be restrained to the seismic restraint manufacturer, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length and width dimensions, installed operating weights of the equipment to be restrained and the distribution of weight at the restraint points.
- C. All piping and equipment is to be restrained to meet code requirements. Spacing between restraints is not to exceed the allowable spacing listed in the latest revision of the SMACNA manual (Sheet Metal and Air Conditioning Contractors National Association, Inc.) “Seismic Restraint Manual Guidelines for Mechanical Systems”, Second Edition, 1998. At a minimum, the seismic restraint manufacturer will provide documentation on maximum restraint spacing for various cable sizes and anchors, as well as ‘worst case’ reaction loads at restraint locations. In addition, seismic restraint manufacturer will provide support documentation containing adequate information to allow the installation contractor to make reasonable field modifications to suit special case conditions.
- D. The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly attached to the building structural flooring, so to withstand anticipated seismic forces. In addition, the size of the housekeeping pad is to be coordinated with the seismic restraint manufacturer so to ensure that adequate edge distances exist in order to obtain desired design anchor capabilities.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- 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:
 - 1. Amber/Booth Company, Inc.
 - 2. Kinetics Noise Control.
 - 3. Mason Industries.
 - 4. Vibration Eliminator Co., Inc.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene.

- C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- D. Restrained Mounts: All-directional mountings with seismic restraint.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- F. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - 2. Base: Factory drilled for bolting to structure.
 - 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.
- G. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- H. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the 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. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- I. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- J. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 AIR-MOUNTING SYSTEMS

- 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:
1. California Dynamics Corporation.
 2. Firestone Industrial Products Company.
 3. Kinetics Noise Control.
 4. Mason Industries.
 5. Vibration Eliminator Co., Inc.
- B. Restrained Air Mounts: Housed compressed-air bellows.
1. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
 2. Maximum Natural Frequency: 3 Hz.
 3. Operating Pressure Range: 25 to 100 psig.
 4. Burst Pressure: At least three times manufacturer's published maximum operating pressure.

5. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch.

2.3 SEISMIC-RESTRAINT DEVICES

- 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:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti, Inc.
 5. Kinetics Noise Control.
 6. Mason Industries.
 7. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by OSHPD.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- G. 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.
- H. 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.

- I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- J. Plumbing 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. Minimum length of eight times diameter.
- K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl 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.

2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PLUMBING VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE APPLICATIONS

- A. Supported or Suspended Equipment: Include all plumbing systems. Equipment buried underground is excluded but entry of services through the foundation wall is included.

Equipment referred to below is typical for the assigned Component Importance Factors of 1.5. (Plumbing equipment that may have been omitted from this list shall still be included in this specification even if it is not listed).

Fuel gas piping
Gas Fired Water Heaters

Plumbing items with Seismic Importance Factors of 1.0 are exempt from seismic re-straint.

- B. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD.
- C. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- D. 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.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 - 1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by OSHPD providing required submittals for component.
- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by OSHPD providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

- F. 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.
- G. 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.
- H. 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.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 11. Test and adjust air-mounting system controls and safeties.
 12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.
- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to 507900 for Demonstration and Training requirements.

END OF DOCUMENT

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment nameplates.
 - 2. Access panel and door markers.
 - 3. Pipe markers.
 - 4. Stencils.
 - 5. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
 - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
 - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
 - 1. Stencil Material: Metal or fiberboard.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

2.4 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 - 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 22 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Water heaters.
 - 2. Hot water recirculating pumps.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
 - 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
 - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
 - 3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
 - 4. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior non-concealed 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 non-accessible 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 markers.

3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.5 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.6 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 22 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - 2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Removable insulation at piping specialties and equipment connections.
 - 4. Application of field-applied jackets.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".

- B. Coordinate clearance requirements with piping Installer for insulation application.

PART 2 - PRODUCTS

2.1 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:

1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.
 - d. Schuller International, Inc.
2. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:

1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.
2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.
3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
 - a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
 - b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.
4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.
5. Mineral-Fiber Insulating Cements: Comply with ASTM C 195.
6. Expanded or Exfoliated Vermiculite Insulating Cements: Comply with ASTM C 196.
7. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

- B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

- C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. PVC Jacket Color: White or gray.
 - 3. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.
- D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil- thick, high-impact, ultraviolet-resistant PVC.
 - 1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
 - 2. Adhesive: As recommended by insulation material manufacturer.
- E. Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.
 - 1. Finish and Thickness: 0.010 inch thick.
 - 2. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - 3. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
- F. Stainless-Steel Jacket: ASTM A 666, Type 304 or 316; 0.10 inch thick; and roll stock ready for shop or field cutting and forming to indicated sizes.
 - 1. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - 2. Elbows: Gore type, for 45- and 90-degree elbows in same material, finish, and thickness as jacket.
 - 3. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..
 - 1. Tape Width: 4 inches.

B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
2. Aluminum: 0.007 inch thick.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.

- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
 - 3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply 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 4 inches o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
 - 4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
 - 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

- R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."
- S. Floor Penetrations: Apply insulation continuously through floor assembly.
 - 1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
 - 2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation segments.
 - 3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
 - 1. Apply preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch, and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
 - 1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
 - 2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
 - 3. Cover fittings with standard PVC fitting covers, when fittings are above 7'0" AFF.
 - 4. Cover fittings with heavy PVC fitting cover, when fittings are below 7'0" AFF. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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 the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.

1. Draw jacket material smooth and tight.
 2. Apply lap or joint strips with the same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Apply jackets with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- C. Apply PVC jacket where indicated, with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
- D. Apply metal jacket where indicated, 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.

3.7 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating to piping insulation located outdoors.

3.8 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
1. Flexible connectors.
 2. Vibration-control devices.
 3. Below-grade piping, unless otherwise indicated.
 4. Chrome-plated pipes and fittings, unless potential for personnel injury.
 5. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.9 FIELD QUALITY CONTROL

- A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
1. Inspect fittings and valves randomly selected by Architect.
 2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
 3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.10 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.11 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Domestic cold water.
 - 1. Operating Temperature: 35 to 60 deg F.
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: Apply the following insulation thicknesses:
 - a. Copper Pipe: 2" and below, ½" thick.
 - b. Copper Pipe: above 2", 1" thick.
 - c. Piping in exterior walls: All sizes: 1" thick.
 - 4. Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- B. Service: Domestic hot and re-circulated hot water (Mains).
 - 1. Operating Temperature: 60 to 140 deg F.
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: 1".
 - 4. Jacket: Foil and paper.
 - 5. Vapor Retarder Required: No.
- C. Service: Domestic hot water (Branch piping).
 - 1. Operating Temperature: 60 to 140 deg F.
 - 2. Insulation Material: Mineral fiber.
 - 3. Insulation Thickness: ½".
 - 4. Jacket: Foil and paper.
 - 5. Vapor Retarder Required: No.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.
- B. See Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and fittings.

1.2 SUBMITTALS

- A. Water Samples: Specified in "Cleaning" Article in Part 3.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," and NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for combined fire-protection and domestic water service piping to building.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- D. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

1.4 EXTRA MATERIALS

- A. The contractor shall provide two sets of each type of tool required for installation of the piping systems identified in this specification section to the University for utilization during repairs to the piping systems. The tools shall include, but not be limited to, pipe cutters, heating irons, portable welding machine, welding heads, etc.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Transition Couplings: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 - 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.
- C. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
 - 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.

2.2 VALVES

- A. Refer to Division 22 Section "Valves" for bronze and cast-iron, general-duty valves.
- B. Refer to Division 22 Section "Plumbing Specialties" for balancing and drain valves.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- 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 may be used on aboveground piping, unless otherwise indicated.
- C. Under-building-slab, domestic water, building-service piping: Use the following piping materials for each size range:
 - 1. NPS 3 and Larger: Mechanical-joint, ductile-iron pipe; standard pattern mechanical-joint fittings; and mechanical joints.

2. NPS 2 and Smaller: Soft copper tube, Type K; copper pressure fittings; and brazed joints.
- D. Above-building-slab, domestic water piping: Use the following piping materials for each size range:
1. NPS 4 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use ductile-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
 4. Drain Duty: Hose-end drain valves.

3.3 PIPING INSTALLATION

- A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping installation.
- B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each domestic water service. Refer to Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages, and to Division 22 Section "Plumbing Specialties" for drain valves and strainers.
- D. Install domestic water piping level and plumb.
- E. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- F. Perform the following steps before operation:
1. Close drain valves, hydrants, and hose bibs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

- G. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- H. Check plumbing specialties and verify proper settings, adjustments, and operation.
 - 1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.
- I. Energize pumps and verify proper operation.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

- A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.
- B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly for piping NPS 2-1/2 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. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Refer to Division 22 Section "Plumbing Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Division 22 Section "Plumbing Specialties" for calibrated balancing valves.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 3. NPS 2: 10 feet with 3/8-inch rod.
 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.
- 3.7 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 service piping with shutoff valve, and extend and connect to the following:
1. Booster Systems: Cold-water suction and discharge piping.
 2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 4. 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 and larger.

3.8 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
 2. 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:
 - 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 for final inspection by 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 test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping 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 domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Cap and subject piping to static water pressure of 50 psig 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.
 4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 5. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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 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 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.

END OF SECTION

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.
- B. Related Sections include the following:
 - 1. Division 22 Section "Plumbing Specialties" for soil, waste, and vent piping systems specialties.

1.3 PERFORMANCE REQUIREMENTS

- A. The owner has experienced pre-occupancy or early occupancy blockages in the underground drain systems. It shall be the Contractor's responsibility to maintain and document a clean and clear drainage system. The scope of this requirement includes, but not limited to:
 - 1. Capping open ends of "rough-in" piping. This includes a mechanical means to prevent objects to be poured or dropped into the underground piping during construction. Tape alone is not acceptable.
 - 2. Scope the entire underground drainage system. This shall include two videotaped records of the drain system to be submitted to the Architect/Owner. The first is at the completion of the underground rough-in, prior to concrete slabs poured over the piping, and the second time shall be prior to fixtures placed.
 - 3. All trades shall be advised of the emphasis that shall be placed on the maintenance of a clean and clear underground piping system
- B. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Gravity Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.

2.2 PVC DWV PIPING.

- A. PVC Pipe: ASTM D 2665, Schedule 40, solid-wall drain, waste and vent (DWV).
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

2.3 CAST-IRON SOIL PIPING

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
 - 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
 - a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
 - 1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
 - 2) NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.

2.4 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.
- B. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 2. Dielectric Nipples:
 - a. Description:
 - 1) Standard: IAPMO PS 66
 - 2) Electroplated steel nipple.
 - 3) Pressure Rating: 300 psig at 225 deg F.
 - 4) End Connections: Male threaded.
 - 5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

- B. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
 - 1. NPS 1-1/4 and NPS 6: PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground, Soil, Waste, and Vent Piping concealed inside walls and not located in environmental plenums: Use the following piping materials for each size range:
 - 1. NPS 1-1/4 and NPS 6: PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Aboveground, Soil, Waste, and Vent Piping exposed to view or installed in an environmental plenum: Use any of the following piping materials for each size range:
 - 1. NPS 1-1/4 to NPS 6: Hubless, cast-iron soil piping and one of the following:
 - a. Couplings: Heavy-duty, Type 304, stainless steel.

3.3 PIPING INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. 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 2 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.
- D. 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.
- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Horizontal Sanitary Building Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

- F. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- G. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment " for seismic-restraint devices.
- B. Refer to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment " for pipe hanger and support devices. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. 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: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 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. Refer to Division 22 Section "Plumbing Fixtures."
 - 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. Refer to Division 22 Section "Plumbing Specialties."
 - 4. 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 and larger.

3.7 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. 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. 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.

3.8 CLEANING

- 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.

3.9 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22 15 13
GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes piping and related specialties for general-service compressed-air systems, as follows:
 - 1. Pipes, tubes, and fittings.
 - 2. Joining materials.
 - 3. Valves.
 - 4. Dielectric fittings.
 - 5. Flexible pipe connectors.
 - 6. Specialties.
 - 7. Quick couplings.
 - 8. Hose assemblies.

1.2 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. HDPE: High-density polyethylene plastic.
- D. High-Pressure, Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig.
- E. Low-Pressure, Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.
- F. NBR: Nitrile butadiene rubber.
- G. PE: Polyethylene plastic.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. Plastic pipes, fittings, and valves.
 - 2. Dielectric fittings.
 - 3. Flexible pipe connectors.
 - 4. Safety valves.
 - 5. Pressure regulators. Include rated capacities and operating characteristics.
 - 6. Automatic drain valves.
 - 7. Filters. Include rated capacities and operating characteristics.
 - 8. Lubricators. Include rated capacities and operating characteristics.
 - 9. Quick couplings.
 - 10. Hose assemblies.
- B. Certificates:
 - 1. Brazing and welding certificates.
- C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For Installer.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Extruded-Tee Outlet Procedure: Qualify operators according to training provided by respective manufacturer, for making branch outlets.
2. Press-Seal Joining Procedure for Copper Tubing: Qualify operators according to training provided by respective manufacturer.
3. Pressure-Seal Joining Procedure for Steel Piping. Qualify operators according to training provided by respective manufacturer.
4. Joining Procedures for Aluminum Piping Systems: Qualify installers according to training provided by respective manufacturer.

B. Brazing: Qualify processes and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or with AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

C. Welding: Qualify processes and operators in accordance with ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Compressed-air piping system to withstand the effects of earthquake motions determined in accordance with **ASCE/SEI 7**. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

2.2 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A53/A53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded in accordance with ASME B1.20.1.

1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
4. Steel Flanges, Threaded: ASME B16.5, Class 150 or 300, carbon steel, threaded.
5. Wrought-Steel, Butt-Welding Fittings: ASME B16.9, Schedule 40.
6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

B. Copper Tube: ASTM B88, Type K or L seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.
2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
3. Copper Unions: ASME B16.22 or MSS SP-123.

- C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D2235.

2.4 VALVES

- A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

2.5 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. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 125 psig minimum at 180 deg F.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.6 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig.
 - 2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
 - 3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.
- B. Stainless Steel-Hose Flexible Pipe Connectors: Corrugated, stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
 - 3. End Connections, **NPS 2-1/2** and Larger: Flanged steel nipple.

2.7 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
 - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Line Pressure Regulators, Bronze Body: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig minimum inlet pressure, unless otherwise indicated.
- C. Air-Line Pressure Regulators, Aluminum Alloy or Plastic Body: Diaphragm operated, aluminum alloy or plastic body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200 psig minimum inlet pressure, unless otherwise indicated.
- D. Automatic Drain Valves: Stainless steel body and internal parts, rated for 200 psig minimum working pressure, capable of automatic discharge of collected condensate.
- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.
- F. Mechanical Filters: Two-stage, mechanical-separation, air-line filters. Equip with deflector plates, resin-impregnated-ribbon filters with edge filtration, and drain cock.

2.8 QUICK COUPLINGS

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- B. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless steel or nickel-plated-steel operating parts.
 - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
 - 2. Plug End: **Flow-sensor-bleeder, check-valve** type with barbed outlet for attaching hose.
- C. Valveless Quick Couplings: Straight-through brass body with stainless steel or nickel-plated-steel operating parts.
 - 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.

2. Plug End: With barbed outlet for attaching hose.

2.9 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300 psig minimum working pressure, unless otherwise indicated.
 1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
 2. Hose Clamps: Stainless steel clamps or bands.
 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
 4. Hose Splicers: One-piece, straight-through brass or stainless steel fitting with barbed ends for connecting two sections of hose.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping: Use the following piping materials for each size range:
 1. NPS 2 and Smaller, Threaded: Schedule 40, black [galvanized]-steel pipe; threaded, malleable-iron fittings; and threaded joints.
 2. NPS 2 and Smaller, Brazed: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
 3. NPS 2-1/2 to NPS 4, Threaded: Schedule 40, black steel pipe; threaded, malleable-iron fittings; and threaded joints.
 4. NPS 2-1/2 to NPS 4, Welded: Schedule 40, black-steel pipe; wrought-steel fittings; and welded joints.
- B. Drain Piping: Use the following piping materials:
 1. NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

3.2 VALVE APPLICATIONS

- A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Article in Section 220523 "General Duty Valves for Plumbing Piping," according to the following:
 1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
 2. High-Pressure Compressed Air: Valve types specified for high-pressure compressed air.
 3. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.3 INSTALLATION OF PIPING, GENERAL

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping concealed from view and protected from physical contact by building occupants, 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 otherwise indicated.

- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Where installing piping adjacent to equipment and machines, allow space for service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
 - 1. Use steel companion flange with gasket for connection to steel pipe.
 - 2. Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Extended-tee outlets with brazed branch connection may be used for copper tubing, within extruded-tee connection diameter to run tube diameter ratio for tube type, in accordance with Extruded Tee Connections Sizes and Wall Thickness for Copper Tube (Inches) Table in ASTM F2014.
- J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- L. Install pressure gauge on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."
- M. Install piping to permit valve servicing.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install seismic restraints on piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

3.4 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 pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with 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 unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints for Steel Piping: Join in accordance with AWS D10.12/D10.12M.
- E. Brazed Joints for Copper Tubing: Join in accordance with AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

- F. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Join in accordance with ASTM B828 or CDA's "Copper Tube Handbook."
- G. Extruded-Tee Outlets for Copper Tubing: Form branches in accordance with ASTM F2014, with tools recommended by procedure manufacturer, and using operators qualified in accordance with "Quality Assurance" Article.
- H. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts in accordance with ASME B31.9 for bolting procedure.
- I. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. NPS 2 and Smaller: Use dielectric unions.
- C. NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.6 INSTALLATION OF FLEXIBLE PIPE CONNECTORS

- A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.
- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.
- C. Install stainless steel-hose flexible pipe connectors in steel compressed-air piping.

3.7 INSTALLATION OF SPECIALTIES

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-main pressure regulators in compressed-air piping at or near air compressors.
- C. Install air-line pressure regulators in branch piping to equipment.
- D. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters.
- E. Install air-line lubricators in branch piping to machine tools.
- F. Install quick couplings at piping terminals for hose connections.
- G. Install hose assemblies at hose connections.

3.8 PIPING CONNECTIONS

- A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
- B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.9 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing."
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for hangers, supports, and anchor devices.
- C. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Support horizontal piping within 12 inches of each fitting and coupling.

- E. Support vertical runs of copper tubing and steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- F. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Ft. or Less: MSS Type 1, adjustable, steel clevis hangers.
 - 2. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
- G. Multiple, Straight, Horizontal Piping Runs **100 Ft.** or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- H. Base of Vertical Piping: MSS Type 52, spring hangers.

3.10 LABELING AND IDENTIFICATION

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

3.11 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect filters and pressure regulators for proper operation.
- C. Prepare test and inspection reports.

END OF SECTION 22 15 13

SECTION 22 33 00
ELECTRIC, DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for domestic water systems:

- 1. Storage type water heaters.
- 2. Accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Product Certificates: Signed by manufacturers of water heaters certifying that products furnished comply with requirements.
- D. Maintenance Data: For water heaters to include in maintenance manuals specified in Division 1.
- E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.

- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on specific units indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Fabricate and label water heater, hot-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.
- E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
 - 1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.

1.5 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 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:
 - 1. Storage Type, Electric Water Heaters:
 - a. Lochinvar Corp.
 - b. Rheem Manufacturing Co.; Rheem Water Heater Div.
 - c. Rheem Manufacturing Co.; Ruud Water Heater Div.
 - d. Smith: A. O. Smith Water Products Co.
 - e. State Industries.

2.2 STORAGE TYPE, ELECTRIC WATER HEATERS

- A. Description: Comply with UL 174.
- B. Storage Tank Construction: Steel with 150-psig working-pressure rating.

1. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, drain, anode rod, and controls as required. Attach tappings to tank before testing and labeling. Include ASME B1.20.1, pipe thread.
 2. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
 3. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
 4. Jacket: Steel, with enameled finish.
 - a. Color: White, unless otherwise indicated.
- C. Heating Elements: Two electric, screw-in, immersion type.
1. Temperature Control: Adjustable thermostat with wiring arrangement for simultaneous operation.
- D. Anode Rod: Factory installed, magnesium.
- E. Dip Tube: Factory installed. Not required if cold-water inlet is near bottom of storage tank.
- F. Drain Valve: ASSE 1005, factory installed.
- G. Heat Trap: Factory-installed, integral piping arrangement or cold-type inlet and hot-type outlet fittings complying with ASHRAE 90.1.

2.3 WATER HEATER ACCESSORIES

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.
1. Option: Separate temperature and pressure relief valves are acceptable instead of combination relief valve.
 2. Exception: Omit combination temperature and pressure relief valve for tankless water heater, and furnish pressure relief valve for installation in piping.
- B. Vacuum Relief Valves: Comply with ASME PTC 25.3. Furnish for installation in piping.
1. Exception: Omit if water heater has integral vacuum-relieving device.
- C. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
- B. Install water heaters, level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend relief valve outlet with water piping in continuous downward pitch and discharge onto closest floor drain.
- D. Install vacuum relief valves in cold-water-inlet piping.
- E. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for drain valves.
- F. Fill water heaters with water.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Make connections with dielectric fittings where piping is made of dissimilar metal.
- D. Electrical Connections: Power wiring and disconnect switches are specified in Division 26 Sections. Arrange wiring to allow unit service.
- E. Ground equipment.
 - 1. 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 and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. In addition to manufacturer's written installation and startup checks, perform the following:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Verify that piping system tests are complete.
 - 3. Check for piping connection leaks.
 - 4. Check for clear relief valve inlets, outlets, and drain piping.

5. Check operation of circulators.
6. Test operation of safety controls, relief valves, and devices.
7. Energize electric circuits.
8. Adjust operating controls.
9. Adjust hot-water-outlet temperature settings. Do not set above 140 deg F unless piping system application requires higher temperature.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water heaters.
 1. Train Owner's maintenance personnel on procedures for starting and stopping, troubleshooting, servicing, and maintaining equipment.
 2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes plumbing fixtures and related components.

1.2 DEFINITIONS

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

1.3 SUBMITTALS

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and maintenance data.

1.4 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.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Hand Sinks: NSF 2 construction.
 - 3. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
 - 4. Vitreous-China Fixtures: ASME A112.19.2M.
 - 5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
 - 6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 2. Faucet Hose: ASTM D 3901.
 - 3. Faucets: ASME A112.18.1M.
 - 4. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 5. Hose-Coupling Threads: ASME B1.20.7.
 - 6. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 7. NSF Materials: NSF 61.
 - 8. Pipe Threads: ASME B1.20.1.
 - 9. Supply and Drain Fittings: ASME A112.18.1M.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1M.
 - 3. Manual-Operation Flushometers: ASSE 1037.
 - 4. Plastic Tubular Fittings and Piping: ASTM F 409.
 - 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
 - 6. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Floor Drains: ASME A112.21.1M.
 - 2. Hose-Coupling Threads: ASME B1.20.7.
 - 3. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 4. Pipe Threads: ASME B1.20.1.
 - 5. Plastic Toilet Seats: ANSI Z124.5.
 - 6. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 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:

1. Available Manufactures:
 - a. Delta Faucet Company.
 - b. Elkay Manufacturing Company.
 - c. Jay R Smith Manufacturing Company.
 - d. Just Manufacturing Company.
 - e. Kohler Company.
 - f. Sloan Valve Company.
 - g. Zurn Industries, LLC.

2.2 PLUMBING FIXTURE SCHEDULE

- A. Refer to the Plumbing Fixture Schedule on Sheet P001 for a description of each plumbing fixture or specialty item utilized on this project. Manufacturer and product number are representative of the type and quality of fixture to be furnished and installed.

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- D. Install wall-hanging fixtures with tubular waste piping attached to supports.
- E. Install counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 22 Section "General-Duty Valves for Plumbing Piping".
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- J. Install toilet seats on water closets.
- K. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- L. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.
- M. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
- O. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for escutcheons.
- P. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.2 CONNECTIONS

- A. Connect water supplies from water distribution piping to fixtures.
- B. Connect drain piping from fixtures to drainage piping.
- C. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

- D. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections:
Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.3 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 00
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following plumbing specialties:
 - 1. Backflow preventers.
 - 2. Water regulators.
 - 3. Balancing valves.
 - 4. Strainers.
 - 5. Key-operation hydrants.
 - 6. Wheel-handle wall hydrants.
 - 7. Trap seal primer valves.
 - 8. Drain valves.
 - 9. Grease interceptors, grease recovery units.
 - 10. Miscellaneous piping specialties.
 - 11. Sleeve penetration systems.
 - 12. Flashing materials.
 - 13. Cleanouts.
 - 14. Floor drains.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for water meters, thermometers, and pressure gages.

1.3 DEFINITIONS

- A. The following are industry abbreviations for plastic piping materials:
 - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
 - 2. PE: Polyethylene plastic.
 - 3. PUR: Polyurethane plastic.
 - 4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
 - 1. Domestic Water Piping: 125 psig.
 - 2. Sanitary Waste and Vent Piping: 10-foot head of water.
 - 3. Storm Drainage Piping: 10-foot head of water.
 - 4. Force-Main Piping: 100 psig.

1.5 SUBMITTALS

- A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
 - 1. Backflow preventers and water regulators.
 - 2. Balancing valves, water filters, and strainers.
 - 3. Thermostatic water mixing valves and water tempering valves.
 - 4. Water hammer arresters, air vents, and trap seal primer valves and systems.
 - 5. Drain valves, hose bibbs, hydrants, and hose stations.
 - 6. Outlet boxes and washer-supply outlets.
 - 7. Backwater valves, cleanouts, floor drains, open receptors, trench drains, and roof drains.
 - 8. Air-admittance valves, vent caps, vent terminals, and roof flashing assemblies.
 - 9. Grease interceptors, grease recovery units, oil interceptors, and solids interceptors.
 - 10. Sleeve penetration systems.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field test reports.
- D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
 - 1. Backflow preventers and water regulators.
 - 2. Water filters.
 - 3. Thermostatic water mixing valves and water tempering valves.
 - 4. Trap seal primer valves and systems.
 - 5. Hose stations and hydrants.

1.6 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

- C. 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.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.
- E. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
 - 2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Water Filter Cartridges: Equal to 100 percent of amount installed for each type and size indicated.
 - 2. Operating Key Handles: Equal to 10 percent of amount installed for each key-operated hose bibb and hydrant installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

- A. Manufacturers:
 - 1. Ames Co., Inc.
 - 2. B & K Industries, Inc.
 - 3. CMB Industries, Inc.; Febco Backflow Preventers.
 - 4. Conbraco Industries, Inc.
 - 5. Mueller Co.; Hersey Meters Div.
 - 6. Watts Industries, Inc.; Water Products Div.

7. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.
2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with non-removable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

2.3 WATER REGULATORS

A. Manufacturers:

1. Armstrong-Yoshitake, Inc.

2. Cla-Val Co.
 3. Conbraco Industries, Inc.
 4. IMI Cash Valve.
 5. Watts Industries, Inc.; Water Products Div.
 6. Zurn Industries, Inc.; Wilkins Div.
- B. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig minimum. Include integral factory-installed or separate field-installed, Y-pattern strainer.
1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
 - b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.
 2. NPS 2-1/2 and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved, interior epoxy coating for regulators with cast-iron body.
 - a. Type: Single-seated, direct operated.
 - b. Type: Pilot-operated, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.
 3. Interior Components: Corrosion-resistant materials.
 4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

2.4 BALANCING VALVES

- A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.
1. Manufacturers:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Flow Design, Inc.
 - d. ITT Industries; Bell & Gossett Div.
 - e. Taco, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 2. NPS 2 and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.

2.5 STRAINERS

- A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body, with female threaded ends.
3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
 - a. Drain: Factory- or field-installed, hose-end drain valve.
5. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.

2.6 KEY-OPERATED HYDRANTS

A. Manufacturers:

1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Watts Industries, Inc.; Drainage Products Div.
4. Woodford Manufacturing Co.
5. Zurn Industries, Inc.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.

1. Inlet: NPS 3/4 threaded or solder joint.
2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: One with each key-operation hydrant.

C. Non-freeze Exposed-Outlet Wall Hydrants: ASSE 1019, self-drainable with integral non-removable hose-connection vacuum breaker, casing and operating rod to match wall thickness, projecting outlet, and wall clamp.

1. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Nozzle and Wall Plate Finish: Rough bronze.

D. Non-freeze Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral non-removable hose-connection vacuum breaker, casing and operating rod to match wall thickness, concealed outlet, and wall clamp.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Box and Cover Finish: Rough bronze.

E. Moderate-Climate, Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral non-removable hose-connection vacuum breaker, and concealed outlet.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Box and Cover Finish: Rough bronze.

2.7 WHEEL-HANDLE WALL HYDRANTS

A. Manufacturers:

1. Arrowhead Brass Products, Inc.
2. B & K Industries, Inc.
3. NIBCO INC.
4. Sioux Chief Manufacturing Co., Inc.
5. Watts Industries, Inc.; Water Products Div.
6. Woodford Manufacturing Co.
7. Zurn Industries, Inc.

- B. Description: Frost-proof design similar to ASME A112.21.3M, for wall mounting with wheel-handle operation, NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, casing and operating rod to match wall thickness, and projecting outlet with ASME B1.20.7 garden-hose threads on outlet. Include wall clamp; integral vacuum breaker or non-removable, drainable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose threads complying with ASME B1.20.7 on outlet.

2.8 TRAP SEAL PRIMER VALVES

- A. Trap Seal Primer System: Factory-fabricated, automatic-operation assembly for wall mounting with the following:

1. Manufacturers:
 - a. Precision Plumbing Products, Inc.
2. Piping: NPS 1/2, ASTM B 88, Type L; copper, water tubing inlet and manifold with number of NPS 1/2 outlets as indicated.

2.9 DRAIN VALVES

- A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.

1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

2.10 MISCELLANEOUS PIPING SPECIALTIES

- A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.
 - 1. Available Manufacturers:
 - 2. Manufacturers:
 - a. Josam Co.
 - b. Smith, Jay R. Mfg. Co.
 - c. Tyler Pipe; Wade Div.
 - d. Zurn Industries, Inc.; Specification Drainage Operation.
- B. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
 - 1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 - 2. Finish for Service Areas: Chrome or nickel plated.
 - 3. Finish for Finished Rooms: Chrome or nickel plated.
 - 4. Operation for Equipment Rooms: Wheel handle or operating key.
 - 5. Operation for Service Areas: Wheel handle.
 - 6. Operation for Finished Rooms: Operating key.
 - 7. Include operating key with each operating-key hose bibb.
 - 8. Include integral wall flange with each chrome- or nickel-plated hose bibb.
- C. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
 - 1. NPS 2: 4-inch- minimum water seal.
 - 2. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- D. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
- E. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.
- F. Stack Flashing Fittings: Counter-flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
- G. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

- H. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counter-flashing.
- I. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.
- J. Conductor Nozzles: Bronze body with threaded inlet for connected conductor size, and bronze wall flange with mounting holes.
 - 1. Finish: Polished bronze.

2.11 SLEEVE PENETRATION SYSTEMS

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. ProSet Systems, Inc.
- C. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
 - 1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 2. Stack Fitting: ASTM A 48, gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
 - a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.12 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-lb/sq. ft., 0.0625-inch thickness.
 - 2. Vent Pipe Flashing: 3-lb/sq. ft., 0.0469-inch thickness.
 - 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152, of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft.
 - 2. Vent Pipe Flashing: 8 oz./sq. ft.

- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
- E. Install draining-type ground post hydrants with 1 cu. yd. of crushed gravel around drain hole.
 - 1. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- F. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- G. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

- H. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- I. 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.
- J. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.
- K. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
- L. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- M. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
- N. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- O. 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 to 60 Inches: Equivalent to 1 percent slope.
 - 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.
- P. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
- Q. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- R. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
- S. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations.

Refer to Division 22 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

- T. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- U. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect plumbing specialties to piping specified in other Division 22 Sections.
- D. Ground equipment.
- E. 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 and UL 486B.
- F. Connect plumbing specialties and devices that require power according to Division 26 Sections.

3.3 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-lb/sq. ft, 0.0938-inch thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- 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 Division 7 Section "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.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer and thermostatic water mixing valve.
 - 1. Text: 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.
 - 2. Refer to Division 22 Section "Mechanical Identification" for nameplates and signs.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 47 16

PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:

1. Electric drinking fountains.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities; furnished specialties; and accessories for each type of fixture indicated.
- B. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 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.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about fixtures for people with disabilities.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
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 manufacturers specified.

2.2 ELECTRIC DRINKING FOUNTAINS

- A. Electric Drinking Fountains, (See plumbing fixture schedule): Accessible, Style W, wall-hanging fixture made of stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elkay Manufacturing Co.
 - b. Halsey Taylor.
 - c. Haws Corporation.
 - d. Oasis Corp.
 2. Cabinet: Steel with powder-coat-finish and stainless-steel deck.
 3. Receptor Shape: Round.
 4. Back Panel: Stainless-steel wall plate behind drinking fountain.
 5. Bubblers: One, with automatic stream regulator, located on deck.
 6. Control: Push bar.
 7. Supply: NPS 3/8 with ball, gate, or globe valve.
 8. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap.
 9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat
 - a. Capacity: minimum 8 gph (unless otherwise specified on drawings) of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
 - b. Electrical Characteristics: fractional hp; 120-V ac; single phase; 60 Hz.
 10. Vandal-Resistant Bottle Filling Station as integral part of Bi-Level, ADA compliant, water cooler. "Green Ticker" to inform user of number of 20 oz. plastic water bottles saved from waste. See plumbing fixture schedule for designation.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.
- B. Use mounting frames for recessed water coolers, unless otherwise indicated.
- C. Set freestanding and pedestal drinking fountains on floor.
- D. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.2 INSTALLATION

- A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.
- B. Install fixtures level and plumb.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Refer to Division 22 Section "Valves" for general-duty valves.
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for escutcheons.

3.3 CONNECTIONS

- A. Connect water supplies from water distribution piping to fixtures.
- B. Connect drain piping from fixtures to drainage piping.

3.4 ADJUSTING

- C. Adjust fixture flow regulators for proper flow and stream height.
- D. Adjust water-cooler temperature settings.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes basic requirements for factory and field-installed motors.

1.3 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

1.4 SUBMITTALS

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
 - 1. Each installed unit's type and details.
 - 2. Nameplate legends.
 - 3. Diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
- C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- D. Qualification Data: For testing agency.

- E. Source quality-control test reports.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.
- C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- D. 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.
- E. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
 - 1. Compatible with the following:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 - c. Reduced-voltage controllers.
 - d. Variable frequency drives.
 - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
 - 3. Matched to torque and horsepower requirements of the load.
 - 4. Matched to ratings and characteristics of supply circuit and required control sequence.

- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory and field installed motors except as follows:
 - 1. Different ratings, performance, or characteristics for motor are specified in another Section.
 - 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.2 MOTOR CHARACTERISTICS

- A. Motors 3/4 HP and Larger: Three phase.
- B. Motors Smaller Than 3/4 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1.
- C. Stator: Copper windings, unless otherwise indicated.

1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designation:
 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
 1. Finish: Gray enamel.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 1. Designed with critical vibration frequencies outside operating range of controller output.
 2. Temperature Rise: Matched to rating for Class B insulation.
 3. Insulation: Class H.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.
 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
 1. Measure winding resistance.
 2. Read no-load current and speed at rated voltage and frequency.
 3. Measure locked rotor current at rated frequency.
 4. Perform high-potential test.

2.5 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split-phase start, capacitor run.
 - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.
- E. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
 - 1. Measure winding resistance.
 - 2. Read no-load current and speed at rated voltage and frequency.
 - 3. Measure locked rotor current at rated frequency.
 - 4. Perform high-potential test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.
- B. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD-INSTALLED MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Install motors on concrete bases complying with Division 3.

- C. Comply with mounting and anchoring requirements specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.3 FIELD QUALITY CONTROL FOR FIELD-INSTALLED MOTORS

- A. Prepare for acceptance tests.
 - 1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
 - 2. Verify bearing lubrication.
 - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - 4. Test interlocks and control and safety features for proper operation.
 - 5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.

3.4 FIELD-INSTALLED MOTOR DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain field-installed motors. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 23 05 15
BASIC HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Mechanical demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 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 manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
1. ABS Piping: ASTM D 2235.
 2. CPVC Piping: ASTM F 493.
 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 4. Aboveground Pressure Piping: Pipe fitting.

- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Available Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.

- f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and non-corrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Available Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

- a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM 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. Include two for each sealing element.
 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 1. Under-deck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 1. Finish: Polished chrome-plated.

- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. 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.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. 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 with spring clips.
 - 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, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - h. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - i. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
 - j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
2. Existing Piping: Use the following:
- a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - g. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
 - h. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - i. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - j. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 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. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using 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.
 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 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.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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 unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Non-pressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.

- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 23 Section "HVAC Piping Insulation" for insulation.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 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. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - l. Piping Technology & Products, Inc.
 - 2. Channel Support Systems:
 - a. B-Line Systems, Inc.
 - b. Grinnell Corp.; Power-Strut Unit.
 - c. GS Metals Corp.

- d. Michigan Hanger Co., Inc.; O-Strut Div.
- e. National Pipe Hanger Corp.
- f. Thomas & Betts Corp.
- g. Unistrut Corp.
- h. Wesanco, Inc.

3. Thermal-Hanger Shield Inserts:

- a. Carpenter & Patterson, Inc.
- b. Michigan Hanger Co., Inc.
- c. PHS Industries, Inc.
- d. Pipe Shields, Inc.
- e. Rilco Manufacturing Co., Inc.
- f. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:

- a. Gunnebo Fastening Corp.
- b. Hilti, Inc.
- c. ITW Ramset/Red Head.
- d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

- 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
- 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

- 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

- 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- 2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
- 3. Material for Cold Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- 4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
6. Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate.
7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
9. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. 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.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. 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.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. 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.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional

attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

- E. Install powder-actuated drive-pin fasteners 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.
- F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- 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. 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 so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. Insulated Piping: Comply with the following:
 - 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 according to ASME B31.9.
 - 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 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 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.
 - 4. 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.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

- d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 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 contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: 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. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS
FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Restrained spring isolators.
 - 5. Housed spring mounts.
 - 6. Elastomeric hangers.
 - 7. Spring hangers with vertical-limit stops.
 - 8. Pipe riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Restrained air-mounting system.
 - 11. Seismic snubbers.
 - 12. Restraining braces and cables.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 119 MPH
 - 2. Building Category: Enclosed.

3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D.
2. Seismic Design Category as Defined in the IBC: D.
 - a. Component Importance Factor: 1.5.
 - b. Component Response Modification Factor: Per Table 13.6-1 of ASCE 7-05 “Minimum Design Loads for Buildings and Other Structures.”
 - c. Component Amplification Factor: Per Table 13.6-1 of ASCE 7-05 “Minimum Design Loads for Buildings and Other Structures.”
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 50.0%.
4. Design Spectral Response Acceleration at 1.0-Second Period: 30.0%.

C. SUBMITTALS

D. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. 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 OSHPD.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

A. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Certification documents to be signed and sealed by a qualified Professional Engineer with at least 5 years’ experience in the design of seismic restraints.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure,

- spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
 4. 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. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
 - d. Preapproval and Evaluation Documentation: By OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
- B. Coordination Drawings: Show coordination of seismic bracing for mechanical piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
- C. Equipment Manufacturer Seismic Qualification Certification: The Equipment Manufacturer must submit certification that each piece of provided equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:
1. Basis for Certification: Indicate whether the "withstand" certification is based on actual test of assembled components or on calculations.
 - a. Indicate the equipment is certified to be durable enough to structurally resist the design forces and will also remain functional after the seismic event.
- D. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- E. Welding certificates.
- F. Qualification Data: For professional engineer and testing agency.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by OSHPD. 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) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.6 WORK FURNISHED BUT NOT INSTALLED

- A. The materials and systems specified in this section shall be purchased by the mechanical contractor from a single seismic snubber restraint materials manufacturer to assure sole source responsibility for the performance of the seismic restraints used.
- B. The materials and systems specified in this section can, at the contractor's option, be installed by the subcontractor who installs the mechanical equipment, piping, or ductwork.

1.7 COORDINATION

- A. Coordinate size, shape, reinforcement and locate cast in place anchor-bolt inserts for concrete Inertia bases. 3000 psi min Concrete and/or formwork as needed is provided by others.

1.8 DESCRIPTION OF SYSTEM

- A. It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and mechanical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.
- B. The work under this section shall include furnishing all labor, materials, tools, appliances, and equipment, and performing all operations necessary for the complete execution of the installation of seismic snubber restraint assemblies as shown, detailed, and/or scheduled on the drawing and/or specified in this section of the specifications

1.9 SYSTEM DESIGN

- A. Seismic snubber manufacturer shall be responsible for the structural design of attachment hardware as required to attach snubbers to both the equipment and supporting structure on vibration isolated equipment, or to directly attach equipment to the building structure for non-isolated equipment.
- B. The contractor shall furnish a complete set of approved shop drawings of all mechanical equipment which is to be restrained to the seismic restraint manufacturer, from which the selection and design of seismic restraint devices and/or attachment hardware will be completed. The shop drawings furnished shall include, at a minimum, basic equipment layout, length and width dimensions, installed operating weights of the equipment to be restrained and the distribution of weight at the restraint points.
- C. All piping and ductwork is to be restrained to meet code requirements. Spacing between restraints is not to exceed the allowable spacing listed in the latest revision of the SMACNA manual (Sheet Metal and Air Conditioning Contractors National Association, Inc.) “Seismic Restraint Manual Guidelines for Mechanical Systems”, Second Edition, 1998. At a minimum, the seismic restraint manufacturer will provide documentation on maximum restraint spacing for various cable sizes and anchors, as well as ‘worst case’ reaction loads at restraint locations. In addition, seismic restraint manufacturer will provide support documentation containing adequate information to allow the installation contractor to make reasonable field modifications to suit special case conditions.
- D. The contractor shall ensure that all housekeeping pads used are adequately reinforced and are properly attached to the building structural flooring, so to withstand anticipated seismic forces. In addition, the size of the housekeeping pad is to be coordinated with the seismic restraint manufacturer so to ensure that adequate edge distances exist in order to obtain desired design anchor capabilities.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- 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:
 - 1. Amber/Booth Company, Inc.
 - 2. Kinetics Noise Control.
 - 3. Mason Industries.
 - 4. Vibration Eliminator Co., Inc.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene.

- C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- D. Restrained Mounts: All-directional mountings with seismic restraint.
 - 1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- F. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - 2. Base: Factory drilled for bolting to structure.
 - 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.
- G. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- H. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the 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. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- I. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- J. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 AIR-MOUNTING SYSTEMS

- 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:
1. California Dynamics Corporation.
 2. Firestone Industrial Products Company.
 3. Kinetics Noise Control.
 4. Mason Industries.
 5. Vibration Eliminator Co., Inc.
- B. Restrained Air Mounts: Housed compressed-air bellows.
1. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
 2. Maximum Natural Frequency: 3 Hz.
 3. Operating Pressure Range: 25 to 100 psig.
 4. Burst Pressure: At least three times manufacturer's published maximum operating pressure.

5. Leveling Valves: Minimum of 3 required to maintain leveling within plus or minus 1/8 inch.

2.3 SEISMIC-RESTRAINT DEVICES

- 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:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti, Inc.
 5. Kinetics Noise Control.
 6. Mason Industries.
 7. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by OSHPD.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- G. 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.
- H. 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.

- I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- J. 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. Minimum length of eight times diameter.
- K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl 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.

2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanized metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 MECHANICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE APPLICATIONS

- A. Supported or Suspended Equipment: Include all mechanical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included.

Equipment referred to below is typical. (Mechanical equipment that may have been omitted from this list shall still be included in this specification even if it is not listed).

Rooftop Units Fans Fuel Gas piping

- B. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD.
- C. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- D. 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.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by OSHPD providing required submittals for component.
- B. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install seismic-restraint devices using methods approved by OSHPD providing required submittals for component.
- E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- F. 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.
- G. 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.

H. 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.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.

9. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
10. Air-Mounting System Operational Test: Test the compressed-air leveling system.
11. Test and adjust air-mounting system controls and safeties.
12. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust air-spring leveling mechanism.

D. Adjust active height of spring isolators.

E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 1 Section "Demonstration and Training." Refer to 507900 for Demonstration and Training requirements.

END OF SECTION

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Pipe paint colors.
 - 5. Duct labels.
 - 6. Stencils.
 - 7. Valve tags.
 - 8. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.

- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. 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.
7. Fasteners: Stainless-steel self-tapping screws.
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 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.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- F. 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.
- G. Fasteners: Stainless-steel self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing. Label shall wrap completely around the pipe and adhere to leading edge of the label.
- D. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
 - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
 - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.
- E. 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.

2.4 DUCT LABELS

- A. General Requirements for Manufactured Duct Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Duct Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 1. Stencil Material: Aluminum.
 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 1. Size: 3 by 5-1/4 inches minimum.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 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.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- 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 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.
- C. Piping Color-Coding: Paints are specified in Division 9 Section "Interior Painting." Paint mechanical items exposed in equipment rooms and occupied spaces (if you can see it, paint it) including, but not limited to, the following:
 - 1. Un-insulated metal piping.
 - 2. Un-insulated plastic piping.
 - 3. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.

4. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
5. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.8 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes testing, adjusting, and balancing of HVAC systems to produce design objectives. **The TAB Agent shall be selected and retained by the Mechanical Contractor.** This Specification Section includes work to be performed by the TAB Agent and identifies the task to be performed by the Mechanical Contractor. The Mechanical Contractor shall cooperate with the TAB Agent and provide assistance as necessary to complete all aspects of the TAB work.
- B. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
 - 1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
 - 2. Adjusting total HVAC systems to provide indicated quantities.
 - 3. Measuring electrical performance of HVAC equipment.
 - 4. Setting quantitative performance of HVAC equipment.
 - 5. Verifying that automatic control devices are functioning properly.
 - 6. Reporting results of the activities and procedures specified in this Section.
- C. Related Sections include the following:
 - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
 - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.3 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. AABC: Associated Air Balance Council.
- N. AMCA: Air Movement and Control Association.
- O. NEBB: National Environmental Balancing Bureau.
- P. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.4 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as

specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.

- D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
- E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.
- F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.5 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.
- B. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- C. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- D. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
 - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
 - 2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine project record documents described in Division 1 Section "Project Record Documents."
- D. Examine Architect's and Engineer's 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 equipment performance data, including fan and pump curves. 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.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

- M. Examine strainers for clean screens and proper perforations.
- N. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- P. Examine equipment for installation and for properly operating safety interlocks and controls.
- Q. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices operate by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in variable-air-volume terminals.
 - 4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 5. Sensors are located to sense only the intended conditions.
 - 6. Sequence of operation for control modes is according to the Contract Documents.
 - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
 - 8. Interlocked systems are operating.
 - 9. Changeover from heating to cooling mode occurs according to design values.
- R. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness 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 design conditions for system operations can be met.
 - 8. Clean filters of the correct size and type have been installed.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in national standards and this Section.

- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- 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 the airflow patterns from the outside-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.

3.5 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Efficiency rating if high-efficiency motor.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter thermal-protection-element rating.

- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.6 HEAT-TRANSFER COILS

- A. Evaporator Coils. Measure the following data for each:
 - 1. Dry-bulb temperatures of entering and leaving air.
 - 2. Wet-bulb temperatures of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.

3.7 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.8 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper and valve operators.
- F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- G. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.
- I. Verify main control supply-air pressure and observe compressor and dryer operations.

- J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.9 TOLERANCES

- A. Set HVAC system airflow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans: 0 to plus 5 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.

3.10 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare 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: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data of all reviews, equipment, devices, etc., include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

3.12 ADDITIONAL TESTS

- A. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 23 Section "Pipe Insulation" for insulation for piping systems.
 - 2. Division 23 Section "Metal Ducts".

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Removable insulation sections at access panels.
 - 2. Application of field-applied jackets.
 - 3. Applications at linkages for control devices.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

1.7 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 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:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens-Corning Fiberglas Corp.

2. Flexible Elastomeric Thermal Insulation:

- a. Armstrong World Industries, Inc.
- b. Rubatex Corp.

3. Coatings, Adhesives, Sealants and Jackets:

- a. Childers Products Company, Inc.
- b. Foster Products.
- c. Polyguard Products, Inc.
- d. Schuller International, Inc.

4. Coatings, Adhesives, Sealants and Jackets:

- a. Childers Products Company, Inc.
- b. Foster Products.
- c. Polyguard Products, Inc.
- d. Schuller International, Inc.

2.2 INSULATION MATERIALS

- A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Polyisocyanurate (polyiso) foam board: Foam board bonded to reinforced aluminum facers on each side. Comply with ASTM C 1289 Type I, Class 1 and 2 for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Tape for Insulation board joints: As recommended by insulation manufacturer.
- C. Field-Applied Jackets: ASTM C 921, Type 1, unless otherwise indicated.
 - 1. Rubberized Bitumen / Aluminum Jacket: Rubberized bitumen compound bonded to cross-laminated high strength polyethylene film with an aluminum foil face, 60 mils total thickness.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. Field-Applied Jackets: ASTM C 921, Type 1, unless otherwise indicated.

1. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
2. Rubberized Bitumen / Aluminum Jacket: Rubberized bitumen compound bonded to cross-laminated high strength polyethylene film with an aluminum foil face, 60 mils total thickness.
3. VentureClad Insulation Jacketing System: Multi-ply laminate, zero permeability self-adhesive aluminum jacket with self-adhesive tape provided as a complete system.

2.4 ACCESSORIES AND ATTACHMENTS

- A. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
 1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.
- B. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.
- C. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
 - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
 - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
 - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
 - 3. Seal insulation to roof flashing with vapor-retarder mastic.
- O. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- P. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- Q. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
 - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, 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 anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, 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 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - 4. Impale insulation over anchors and attach speed washers.

5. 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.
 6. 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 segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
 8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round duct elbows with individually mitered gores cut to fit the elbow.
 9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
- B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, 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. Space anchor pins as follows:
 - a. On duct sides with dimensions 18 inches and smaller, 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 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 4. 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.
 5. 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 segment with 1/2-inch staples, 1-inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply 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 the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
9. Apply glass cloth jacket over board insulation when installed below 7'0" above finished floor.

3.5 POLYISOCYANURATE BOARD THERMAL INSULATION APPLICATION

A. Apply insulation to ducts and plenums as follows:

1. Follow the manufacturer's written instructions for applying insulation. Insulation shall be installed in such a manner to allow water not to pond on top and drain to the sides of the insulated edges.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive and tape. Joints shall be tightly butted together. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.
3. Apply Rubberized Bitumen / Aluminum Jacket to clean polyisocyanurate foiled face surface, with overlap, per manufacturer's recommendations.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.7 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply, return and outside-air ductwork.
2. Indoor exposed supply, return and outside-air ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors.
4. Vibration-control devices.
5. Testing agency labels and stamps.
6. Nameplates and data plates.
7. Access panels and doors in air-distribution systems.

3.8 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Supply-air and return-air ducts located within the building envelope; Exhaust air ducts located within the building envelope shall not be insulated unless indicated otherwise.
1. Material: Mineral-fiber blanket.
 2. Thickness: 2.2 inches.
 3. Density: 0.75 pcf
 4. Installed R-Value: 6.0
 5. Number of Layers: One.
 6. Factory-Applied Facing: Scrim-reinforced, foil-kraft paper and vinyl film (FSK).
 7. Vapor Retarder Required: Yes.
- B. Service: Supply-air, return-air and outside-air ducts located in un-conditioned attics, shops, or mechanical rooms.
1. Material: Mineral-fiber blanket.
 2. Thickness: 3.0 inches.
 3. Density: 0.75 pcf
 4. Installed R-Value: 8.3
 5. Number of Layers: One.
 6. Factory-Applied Facing: Scrim-reinforced, foil-kraft paper and vinyl film (FSK).
 7. Vapor Retarder Required: Yes.

3.9 OUTDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Rectangular, exterior exposed to weather, supply air and return-air ducts.
1. Material: Closed-cell polyisocyanurate foam core board bonded to reinforced aluminum foil facers on each side.
 2. Thickness: 2 inch per layer.
 3. Density: 2.0 pcf.
 4. Thermal Conductivity: 0.152 Btu-in/hr-ft²-deg F @ 75 deg. F mean
 5. Number of Layers: one (1), tightly butted, complete coverage.
 6. Factory-Applied Facing: Foil facers on board.
 7. Field-Applied Jacket: Rubberized Bitumen / Aluminum or VentureClad.

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 23 Section "Duct Insulation" for insulation for ducts and plenums.
 - 2. Division 23 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
 - 2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Removable insulation at piping specialties and equipment connections.
 - 4. Application of field-applied jackets.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports."

- B. Coordinate clearance requirements with piping Installer for insulation application.

PART 2 - PRODUCTS

2.1 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:
 - 1. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.
 - b. Rubatex Corp.

2.2 INSULATION MATERIALS

- A. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- B. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.3 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
 - 1. Apply insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
 - 3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches. Apply 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 4 inches o.c.
 - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

S. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.4 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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 the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.5 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating to piping insulation located outdoors.

3.6 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
1. Flexible connectors.
 2. Vibration-control devices.
 3. Below-grade piping, unless otherwise indicated.
 4. Chrome-plated pipes and fittings, unless potential for personnel injury.
 5. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.7 FIELD QUALITY CONTROL

- A. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
1. Inspect fittings and valves randomly selected by Architect.
 2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
 3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.
- B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.8 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.9 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Service: Air conditioning condensate drain piping and refrigerant (suction line) piping.
 - 1. Operating Temperature: 35 to 75 deg F.
 - 2. Insulation Material: Flexible elastomeric.
 - 3. Insulation Thickness: $\frac{3}{4}$ "
 - 4. Field-Applied Jacket: None.
 - 5. Vapor Retarder Required: Yes.
 - 6. Finishes: See part 3.5 above.

END OF SECTION

SECTION 23 08 00**FIELD VERIFICATION OF HVAC SYSTEMS**

The HVAC and Plumbing contractors SHALL submit the attached form one (1) week prior to the need of a substantial completion review by Corbett Legge and Associates.

ITEMS NEEDED FOR SUBSTANTIAL COMPLETION OBSERVATION BY ENGINEER

PROJECT:			FIELD REPORT NO: Ready for Substantial Completion
CLIENT PROJECT NO:			CLA PROJECT NO:
DATE:	TIME: N/A	WEATHER: N/A	TEMP RANGE: N/A
SUBMIT TO: Eric Blake, (CLA - Construction Administration)			
The following items MUST be completed and ALL reports back to the engineer one week prior to scheduling Substantial Completion site observation. MECHANICAL, PLUMBING, FIRE PROTECTION & ELECTRICAL ITEMS: ☐ 1. The M,P, FP&E contractors MUST submit his job site inspection report listing all items found defective. Each of these items MUST be marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 2. Test and Balance must be completed and report submitted to engineer prior to scheduling Substantial Completion site observation. _____ Completed ☐ 3. All prior Field Observation Reports by the engineer MUST be submitted back to the engineer with all items marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 4. All Pre-Functional Checklists (furnished by the contractor / supplier) must be completed and submitted back to the engineer with all items marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 5. All Checklists performed by systems vendor must be completed and submitted to the engineer with all items marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 6. The following people <u>MUST</u> be present at substantial completion observation by the engineer: ☐ M,P,FP&E Contractors ☐ HVAC Controls Tech ☐ Fire Alarm System Tech _____ Completed			

- ☐ 7. The MPE Contractor must have the following items on hand for the Substantial Completion Site Observation:
 - ☐ Six foot step ladder
 - ☐ Flash Light
 - ☐ Two radios for communicating (Electrical Contractor only)
 - ☐ Amp & Volt Meter (Electrical Contractor only)
 - ☐ Contract documents (plans, specs & submittals)
 - ☐ _____ **Completed**

GENERAL ITEMS:

1. The M,P,FP&E contractors shall sign below stating that ALL items required under the scope of division #22, 23, and #26 have been provided / installed and is in proper working order. The signature below also states that ALL items provided under division #22, 23 and #26 has been tested and are in proper working order.

_____ **MP&E Contractor's Signature of Completion**

_____ **Date of Signature**

SPECIAL NOTE:

IF ALL ITEMS MENTIONED ABOVE ARE NOT COMPLETED AND THE CONTRACTOR SCHEDULES A SUBSTANTIAL COMPLETION SITE REVIEW WITH THE ENGINEER, THE ENGINEER WILL BE COMPENSATED BY THE CONTRACTOR AT CLA RETAIL RATES FOR EACH ADDITIONAL VISIT TO THE SITE.

SIGNATURE AND DATE OF SUBCONTRACTOR PERSON REQUESTING SUBSTANTIAL COMPLETION SITE VISIT BY ENGINEER.

_____ **(Subcontractor's Signature & Date)**

SIGNATURE AND DATE OF GENERAL CONTRACTOR STATING HE HAS REVIEWED THE PROJECT AND IT IS READY FOR SUBSTANTIAL COMPLETION SITE VISIT BY ENGINEER.

_____ **(General contractor's Signature & Date)**

END OF SECTION

SECTION 23 11 94

FUEL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes fuel gas piping, specialties, and accessories within the building downstream of the building gas regulator.

1.3 PROJECT CONDITIONS

- A. Gas System Pressure Range: 5 psig or less.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Corrugated, stainless-steel tubing systems. Include associated components.
 - 2. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
 - 3. Service meters. Include pressure rating and capacity of selected models.
 - 4. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.5 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.
- B. ANSI Standard: Comply with ANSI Z223.1, "National Fuel Gas Code."
- C. FMG Standard: Provide components listed in FMG's "Fire Protection Approval Guide" if specified to be FMG approved.

- D. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.
- E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

1.6 COORDINATION

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
- B. Coordinate gas service modifications with serving utility company and site utility plans. Pay all cost and fees.
- C. Upon completing the gas service modifications and restoring gas service to the school, make certain that all existing gas-fired equipment is operational, including, but not limited to heating equipment, water heaters, and cooking equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 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 manufacturers specified.

2.2 PIPING MATERIALS

- A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
 - 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
 - 3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
 - 4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
 - 5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
 - 6. Joint Compound and Tape: Suitable for natural gas.
 - 7. Steel Flanges and Flanged Fittings: ASME B16.5.

8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.

C. Transition Fittings: Type, material, and end connections to match piping being joined.

D. Common Joining Materials: Refer to Division 22 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

2.3 PROTECTIVE COATING

A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in corrosive atmosphere.

2.4 SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

2.5 VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

G. General-Duty Valves, NPS 2-1/2 and Larger: MSS SP-70, ASME B16.38, cast-iron body gate valves, OS&Y type with solid wedge, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Use flanges, unions, transition, and special fittings in applications below, unless otherwise indicated.
 - 1. NPS 1/2 to NPS 2: Steel pipe, malleable-iron threaded fittings, and threaded joints.
 - 2. NPS 1/2 and Smaller: Corrugated, stainless-steel tubing system and threaded joints.
 - 3. NPS 2-1/2 and larger: Steel pipe, steel welding fittings, and welded joints.

3.2 VALVE APPLICATIONS

- A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.
- B. Piping Line Valves, NPS 2 and Smaller: Gas valve.
- C. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.3 INSTALLATION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements and piping joint construction.
- B. System Gas Pressure above 2 psig: Where gas operating pressure exceeds 2 psig, piping installed inside the building shall be Schedule 40, seamless, black steel pipe with welded joints.
- C. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
 - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves above ceilings.
 - 2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
 - 3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
 - 4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.

- D. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- E. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.
- F. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- G. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- H. Connect branch piping from top or side of horizontal piping.
- I. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- J. Install corrugated, stainless-steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.
- K. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.
- L. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

3.4 HANGERS AND SUPPORTS

- A. Refer to Division 23 Section "Hangers and Supports for Plumbing Piping and Equipment " for pipe hanger and support devices.
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.5 CONNECTIONS

- A. Install piping adjacent to appliances to allow service and maintenance. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

3.6 FIELD QUALITY CONTROL

- A. Furnish, install and test all fuel gas piping in accordance with all requirements of authority having jurisdiction, including any adopted federal, state or local regulations and amendments.
- B. In the absence of any state or local requirements, inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging". Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- C. Paint all new exterior exposed gas piping with two coats of brush on enamel paint. Prepare piping surfaces prior to painting. Color to be equal to Rustoleum gloss safety yellow to match existing gas piping color.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
 - 1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.
- C. Welding and brazing certificates
- D. Field quality-control test reports.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."
- B. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- C. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- D. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Non-electrical"; or UL 429, "Electrically Operated Valves."

PART 2 - PRODUCTS

2.1 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:
1. Refrigerants:
 - a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
 - b. DuPont Company; Fluorochemicals Div.
 - c. Elf Atochem North America, Inc.; Fluorocarbon Div.
 - d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.
 2. Refrigerant Valves and Specialties:
 - a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
 - b. Danfoss Electronics, Inc.
 - c. Emerson Electric Company; Alco Controls Div.
 - d. Henry Valve Company.
 - e. Rawal Devices, Inc.
 - f. Sporlan Valve Company.

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR
- B. Annealed-Temper Copper Tube: ASTM B 280, Type ACR
- C. Wrought-Copper Fittings: ASME B16.22.
- D. Wrought-Copper Unions: ASME B16.22.
- E. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver)

2.3 PRE-INSULATED REFRIGERANT PIPING LINE SETS (Ductless Split-systems only)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are limited to the following:
1. Pre-insulated Refrigerant Line-sets for Ductless split-systems:
 - a. Line-sets constructed of ASTM B280 annealed, refrigerant grade, ACR type, copper tubes individually insulated with single piece molded closed cell foam approved for use by Ductless Split-Systems supplier.

2.4 VALVES

- A. Packed-Angle Valves: 500-psig working pressure and 275 deg F working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.
- B. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.
- C. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

2.5 REFRIGERANT PIPING SPECIALITIES

- A. Moisture/Liquid Indicators: 500-psig maximum working pressure and 200 deg F operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.
- B. Permanent Filter-Dryer: 350-psig maximum operating pressure and 225 deg F maximum operating temperature; steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

2.6 REFRIGERANTS

- A. ASHRAE 34, R-32: Difluoromethane.
- B. ASHRAE 34, R-454B: Zeotropic blend of difluoromethane and tetrafluoropropene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Aboveground, within Building: Type ACR drawn-copper tubing.

3.2 VALVE APPLICATIONS

- A. Install diaphragm packless or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.
- B. Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

- C. Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.
- D. Install diaphragm packless or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.
- E. Install thermostatic expansion valves as close as possible to evaporator.
 - 1. If refrigerant distributors are used, install them directly on expansion-valve outlet.
 - 2. Install valve so diaphragm case is warmer than bulb.
 - 3. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 4. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- F. Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

3.3 SPECIALTY APPLICATIONS

- A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.
- B. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.
- C. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

3.4 PIPING INSTALLATION

- A. Install refrigerant piping according to ASHRAE 15.
- B. Basic piping installation requirements are specified in Division 23 Section "Basic HVAC Materials and Methods."
- C. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- D. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- E. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- F. Belowground, install copper tubing in protective conduit. Vent conduit outdoors.

- G. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- H. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- I. Install bypass around moisture-liquid indicators in lines larger than NPS 2.
- J. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.
- K. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.
- L. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment".
- M. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe rollers for multiple horizontal runs 20 feet or longer, supported by a trapeze.
 - 4. Spring hangers to support vertical runs.
- N. Install hangers with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- O. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

- A. Braze joints according to Division 23 Section "Basic HVAC Materials and Methods."
- B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.6 FIELD QUALITY CONTROL

- A. Test all refrigerant piping in accordance with all requirements of authority having jurisdiction, including any adopted federal, state or local regulations and amendments.
- B. In the absence of any state or local requirements test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
 - 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
 - 2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
 - a. System shall maintain test pressure at the manifold gage throughout duration of test.
 - b. Test joints and fittings by brushing a small amount of soap and glycerin solution over joint.
 - c. Fill system with nitrogen to raise a test pressure of 150 psig or higher as required by authorities having jurisdiction.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter-dryer after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes rectangular and round metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.
 - 1. Rectangular ducts and fittings.
 - 2. Single-wall, round, spiral-seam ducts and formed fittings.
- B. Related Sections include the following:
 - 1. Division 23 Section "Mechanical Insulation" for duct insulation.
 - 2. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounted access doors and panels, turning vanes, and flexible ducts.
 - 3. Division 23 Section "Diffusers, Registers, and Grilles."
 - 4. Division 23 Section "Testing, Adjusting, and Balancing" for air balancing and final adjusting of manual-volume dampers.

1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula $\text{Btu} \times \text{in./h} \times \text{sq. ft.} \times \text{deg F}$ or $\text{W/m} \times \text{K}$ at the temperature differences specified. Values are expressed as Btu or W.
 - 1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect / Engineer. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal ducts.
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Fittings.
 - 3. Reinforcement and spacing.
 - 4. Seam and joint construction.
 - 5. Penetrations through fire-rated and other partitions.
 - 6. Equipment installation based on equipment being used on Project.
 - 7. Duct accessories, including access doors and panels.
 - 8. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.
 - 9. Duct liner type (only where indicated on plans).
- B. Field quality-control test reports.
- C. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

- A. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. ANSI / SMACNA:
 - 1. "HVAC Duct Construction Standards, Metal and Flexible." 2005 Edition.
 - 2. "IAQ Guidelines for Occupied Buildings Under Construction." 2007 Edition.
 - 3. "HVAC Air Duct Leakage Test Manual." 1985 Edition

PART 2 - PRODUCTS

2.1 SINGLE-WALL 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 1-4, "Transverse (Girth) 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. Static Pressure Classes Exceeding 1" w.g.: Joints exceeding 24 inches in either dimension shall utilize prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement or formed-on flanges constructed according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details
 - a. Manufacturers:
 - 1) Ductmate Industries, Inc.
 - 2) Lockformer.
 - 3) Nexus Inc.
 - 4) Ward Industries, Inc.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," 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." Longitudinal Seams:
 1. Static Pressure Classes Exceeding 1" w.g.: Longitudinal seams shall be sealed with non-curing polymer sealant.
- 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 2, "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."
- E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

2.2 SINGLE-WALL 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. Eastern Sheet Metal, Inc.
 - b. Lindab Inc.
 - c. McGill AirFlow LLC.

- d. SEMCO Incorporated.
 - e. Sheet Metal Connectors, Inc.
 - f. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," 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. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 - 3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," 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. Ductwork shall be fabricated with spiral seam or grooved seam (pipe lock or flat lock). Ductwork with snaplock seams shall not be used.
 - 2. 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 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "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."
- E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- F. Elbows: Fabricate elbows using die-formed or gored construction. Bend radius of die-formed and gored elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
- 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 - 2. Round Gored Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
 - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.

- d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
- 3. Die-Formed Elbows for Sizes through 12 Inches in Diameter: 0.040 inch thick with 2-piece welded construction.
- 4. Round Elbows Larger Than 12 Inches in Diameter: Fabricate gored elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
- 5. Adjustable angle, multi-piece fittings shall not be used.

2.3 SHEET METAL 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: Lock-forming quality; complying with ASTM A 653/A 653M and having G90coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. 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.

2.4 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
- B. Joint and Seam Tape: 3 inches wide; 2 mil aluminum bonded to gray butyl adhesive, 15 mil total thickness equal to Hardcast Foil-Grip 1402; no exceptions.
- C. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Rods for Non-corrosive Environments: Cadmium-plated steel rods and nuts.
- C. Hanger Rods for Corrosive Environments: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- D. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
1. Mechanical Equipment Rooms: Ductwork shall be supported with trapeze type hangers utilizing threaded rod. Strap hangers may be utilized on ductwork that does not exceed 24 inches in width if installed with the top of duct located within 8 inches of the upper attachment.
 2. Ductwork Located Outside of Mechanical Equipment Rooms: Ductwork shall be supported with trapeze type hangers utilizing threaded rod. Strap hangers may be utilized on ductwork that does not exceed 30 inches in width.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124. **Duct liner shall be utilized for acoustical treatment and insulation of ductwork and plenums only where indicated on the documents.** Where duct liner is indicated, external duct wrap may be omitted.
1. Manufacturers:
 - a. CertainTeed Corp.; Insulation Group.
 - b. Johns Manville International, Inc.
 - c. Knauf Fiber Glass GmbH.
 - d. Owens Corning.
 2. Materials: ASTM C 1071; surfaces exposed to air-stream shall be coated to prevent erosion of glass fibers and shall be resistant to microbial growth (ASTM G21, ASTM G22).
 - a. Thickness: 1.0 inch.
 - b. Density: 1.5 PCF.

- c. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
- d. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
- e. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
- f. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - 1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
 - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
 - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
 - 1. Supply Ducts: 2-inch wg (including outdoor air ducts).
 - 2. Return Ducts: 2-inch wg (negative pressure).
 - 3. Exhaust Ducts: 2-inch wg (negative pressure).

3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round ducts in lengths not less than 10 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- 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. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Penetration Firestopping."
- O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems".
- P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction."
- Q. Paint interiors of metal ducts that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 - 1. For pressure classes equal to or lower than 2-inch wg, seal all transverse and longitudinal joints/seams and branch connections with solvent-based duct sealant.
 - 2. For pressure classes greater than 2-inch wg, seal all transverse and longitudinal joints/seams, branch connections and duct wall penetrations with solvent-based duct sealant.
- B. Seal ducts and complete leakage testing prior to installation of external insulation.

3.4 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1. Fan discharges.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.
- I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.5 HANGING AND SUPPORTING

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "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.
- D. Mechanical Equipment Rooms: Ductwork shall be supported with trapeze type hangers utilizing threaded rod. Strap hangers may be utilized on ductwork that does not exceed 24 inches in width if installed with the top of duct located within 8 inches of the upper attachment.
- E. Ductwork Located Outside of Mechanical Equipment Rooms: Ductwork shall be supported with trapeze type hangers utilizing threaded rod. Strap hangers may be utilized on ductwork that does not exceed 30 inches in width.
- F. 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.
- G. 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. Install upper attachments with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class. Duct fabrication, reinforcement, sealing and support shall comply with the requirements of the above standard.
- B. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction". In addition to the requirements of this standard, the contractor shall comply with the following project specific requirements.
 1. Since it is very difficult on an active construction jobsite to control the contamination of ductwork by dirt, dust and / or mud, the contractor shall endeavor to maintain a high standard of duct cleanliness during all stages of construction as follows:

- a. Provide a clean environment for the storage of all duct, fittings, duct accessories, etc.
 - b. Flat oval and round spiral duct and fittings shall have all openings sealed with a plastic or polyethylene film or sheet to prevent the entry of dirt or dust. The materials shall be stored in a dust/ dirt free area.
 - c. Rectangular ductwork and fittings shall have all openings sealed with a plastic or polyethylene film or sheet to prevent the entry of dirt or dust. The materials shall be stored in a dust/ dirt free area.
 2. All duct and fittings shall remain sealed until it is necessary to remove the temporary seal for installation. Openings in the installed ductwork shall be closed as soon as possible to prevent contamination of the ductwork on the construction jobsite. Any ductwork that is found to be contaminated shall be cleaned and temporarily re-sealed before the installation of other ductwork may continue.
 3. All mechanical equipment shall be temporarily sealed and shall remain sealed until it is necessary to remove the temporary seals for installation of ductwork. Openings in the mechanical equipment shall be closed as soon as possible to prevent contamination of the equipment on the construction jobsite. Any equipment that is found to be contaminated shall be cleaned and temporarily sealed before the installation of other equipment may continue.
 - C. **A certified Test and Balance Agent shall assist in performing the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual". The role of the Test and Balance Agent is to witness the test, review the leakage calculations and prepare the test reports. The contractor shall provide the Test and Balance Agent a certified performance graph for the orifice used in the test apparatus. The certified orifice performance shall be matched to the orifice of the test apparatus by serial number.** The installing contractor shall prepare the ductwork for testing, conduct preliminary testing to determine the duct is sealed and assist the Test and Balance Agent in accomplishing the following objectives as required:
 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
 3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
 4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.
- 3.8 CLEANING NEW SYSTEMS
- A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

- B. Use service openings, as required, for physical and mechanical entry and for inspection.
 - 1. Create other openings to comply with duct standards.
 - 2. Disconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Clean the following metal duct systems by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
- D. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
 - 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- E. Cleanliness Verification:
 - 1. Visually inspect metal ducts for contaminants.
 - 2. Where contaminants are discovered, re-clean and re-inspect ducts.

END OF SECTION

SECTION 23 33 00
DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Manual-volume dampers.
 - 2. Turning vanes.
 - 3. Duct-mounted access doors and panels.
 - 4. Flexible ducts.
 - 5. Flexible connectors.
 - 6. Duct accessory hardware.
- B. Related Sections include the following:
 - 1. Division 23 Section "Dedicated Outside-Air Units."
 - 2. Division 23 Section "Diffusers, Registers, and Grilles."

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manual-volume dampers.
 - 2. Duct-mounted access doors and panels.
 - 3. Flexible ducts.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
 - 1. Special fittings and manual- and automatic-volume-damper installations.
 - 2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- C. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.
- D. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
 - 1. Pressure Classifications of 2-inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
- C. Jackshaft: 1-inch- diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
- D. Damper Hardware: 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. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.3 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Fabrication and installation shall comply with SMACNA figure No. 4-3 and 4-4.

2.4 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
- B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of locks as indicated for duct pressure class. Include vision panel where indicated. Include cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.5 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- C. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- D. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.6 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- thick, glass-fiber insulation around a continuous inner liner.

1. Reinforcement: Steel-wire helix encapsulated in inner liner.
 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
 3. Inner Liner: Polyethylene film.
- C. Pressure Rating: 6-inch wg positive, 1/2-inch wg negative.

2.7 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 length to suit duct insulation thickness.
- B. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On both sides of duct coils and downstream of terminal unit reheat coil.
 2. Downstream from control dampers and controls equipment.
 3. Adjacent to and close enough to fire or smoke dampers, 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. A minimum of head and hand access is required.
 4. Elsewhere as indicated.
- E. Install access doors with swing against duct static pressure.
- F. Install the following sizes for duct-mounting, rectangular access doors:
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.
- G. Install the following sizes for duct-mounting, round access doors:
1. One-Hand or Inspection Access: 8 inches in diameter.
 2. Two-Hand Access: 10 inches in diameter.
 3. Head and Hand Access: 12 inches in diameter.
 4. Head and Shoulders Access: 18 inches in diameter.
 5. Body Access: 24 inches in diameter.
- H. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- I. Install flexible connectors to connect ducts to equipment.
- J. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- K. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.
- L. Connect diffusers or light troffer boots to low-pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with draw bands.
- N. Install duct test holes where required for testing and balancing purposes.
- O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.
- P. Label cables / wall plate ports for each respective remote balancing damper. Coordinate balancing with Testing, Adjusting, and Balancing (TAB) agent.
- 3.2 ADJUSTING
- A. Adjust duct accessories for proper settings.
 - B. Adjust fire and smoke dampers for proper action.
 - C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 23 33 10

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fixed, extruded-aluminum louvers.
 - 2. Combination louver damper, extruded-aluminum louvers with actuator.
- B. Related Sections include the following:
 - 1. Division 26 Sections for electrical power connections for motor-operated adjustable metal louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.
 - 1. Wind Loads: Determine loads based on a uniform pressure of 25 lbf/sq. ft, acting inward or outward.
- B. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other

detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

- C. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Airborne Sound Transmission Loss: Provide acoustical louvers complying with airborne sound transmission loss ratings indicated, as demonstrated by testing manufacturer's stock units identical to those specified, except for length and width according to ASTM E 90.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
 - 1. For installed louvers and vents indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Damper actuator: Type, linkage method, and voltage.
 - 3. Wiring Diagrams: Power, signal, and control wiring for motorized adjustable louvers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of metal finish required.
- E. Qualification Data: For professional engineer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- D. UL and NEMA Compliance: Provide motors and related components for motor-operated adjustable louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 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. Louvers:
 - a. Arrow United Industries.
 - b. Greenheck.
 - c. NCA Manufacturing, Inc.
 - d. Ruskin Company; Tomkins PLC.
 - e. An Approved Equal

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.

- E. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Maintain equal louver blade spacing to produce uniform appearance.
- E. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel, unless otherwise indicated.
- F. Include supports, anchorages, and accessories required for complete assembly.
- G. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
- H. Where indicated, provide subsills made of same material as louvers or extended sills for recessed louvers.
- I. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.
- J. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Drainable Blade, Stationary Louver:

1. Louver Depth: 4 inches nominal. See Louver Schedule.
2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.081 inch for blades and 0.081 inch for frames.
3. Performance Requirements:
 - a. Free Area: Not less than 9.40 sq. ft. for 48-inch- wide by 48-inch- high louver.
 - b. Air Performance: Not more than 0.10-inch wg static pressure drop at 700-fpm free-area velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rain fall rate of 3 inches per hour and a wind speed of 29 mph at a core area intake velocity of 700 fpm.
4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Bird screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. 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.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Install specialty louvers (Wind-Storm Rated) with flanged connection on jambs and anchor to storm shelter structure per manufacturer's published installation instructions.
- C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- D. Form closely fitted joints with exposed connections accurately located and secured.
- E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

- 1. Ceiling-mounting ventilators.
- 2. Propeller Fans.
- 3. In-line Centrifugal Fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on sea-level conditions.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material gages and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Provide fan curves for each fan at the specified operation point with the flow, static pressure and horsepower clearly plotted.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

- C. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

1.5 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.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate installation of equipment supports, wall penetrations, and roof penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Manufacturers:
 - a. Cook, Loren Company.
 - b. Greenheck Fan Corp.
 - c. Penn Ventilation Companies, Inc.

2.2 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Plastic, non-yellowing louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Solid state speed controller.
 - 3. Isolation: Rubber-in-shear vibration isolators.
 - 4. Factory furnished backdraft damper.
 - 5. Manufacturer's transition fittings.
 - 6. Aluminum wall cap with integral bird screen.

2.3 PROPELLER FANS

- A. Description: Direct-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, and accessories.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Fan Wheel: Fabricated aluminum blade riveted to steel hub.
- D. Direct-Driven Drive Assembly: Resiliently mounted to housing, statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower.
 - 1. A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft.
 - 2. Statically and dynamically balanced in accordance with AMCA Standard 204-05.
 - 3. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
- E. Motors:
 - 1. Motor enclosures: EC motor with speed dial for balancing.

2. Motors are permanently lubricated, sleeve bearing type on sizes 8-12 and ball bearing type on sizes 14-24 to match with the fan load and furnished at the specific voltage and phase.
3. Accessible for maintenance.

F. Accessories:

1. Motorized Damper with end switch: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Wall Housing: Galvanized steel with mounting flanges and mounting holes.
3. Protective Back Guard for wall housing: Welded steel wire, with thermal setting coating, complying with OSHA specifications, removable for maintenance.
4. Disconnect Switch: Nema 1 toggle switch, field mounted.
5. Aluminum weatherhood, 45 degree discharge with birdsreen.
6. Wall Thermostat: 115 volt line voltage, 40-110 degree F. range, with on-off-auto switch.

2.4 IN-LINE CENTRIFUGAL FANS

- A. Description: In-line, belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, belt-drive assembly with adjustable motor pulley and motor plate, mounting brackets, and accessories.
- B. Housing: Galvanized steel with inlet and outlet duct flanges, bolted access panel, and support bracket adaptable to floor, side wall, or ceiling mounting. Insulated housing and motor cover.
- C. Fan Wheels: Aluminum, backward inclined aluminum wheel.
- D. Accessories:
 1. Bearings with grease fitting.
 2. Isolation: Spring hanging vibration isolators.
 3. OSHA approved motor guard.
 4. Factory wired disconnect switch located on outside of fan housing.

2.5 MOTORS

- A. Refer to Division 23 Section "Motors" for general requirements for factory-installed motors.
- B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B. ECM, high efficiency or inverter duty.
- C. Enclosure Type: Totally Enclosed Fan Cooled.

2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant

Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment.
- D. 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 and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Equipment Startup Checks:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Verify lubrication for bearings and other moving parts.
 - 6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 7. Disable automatic temperature-control operators.

- B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
 2. Measure and record motor voltage and amperage.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Shut unit down and reconnect automatic temperature-control operators.
- F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- G. Replace fan and motor pulleys as required to achieve design airflow.
- H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Verify speed controller is operational.
- C. Lubricate bearings.

3.5 CLEANING

- A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following ceiling- and wall-mounted air outlets and inlets:
 - 1. Diffusers.
 - 2. Registers.
 - 3. Grilles.

1.2 SUBMITTALS

- A. Product Data: For each model indicated, include the following:
 - 1. Data Sheet: Indicate construction, finish, and mounting details for each type of air outlet, inlet, and accessory indicated.
 - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet indicated.
 - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories.
 - 4. Assembly Drawing: Indicate materials and methods of assembly of components for each type of air outlet and inlet indicated.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraphs titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.2 DIFFUSERS

A. Diffuser: See Air Distribution Schedule.

1. Available Products:
 - a. Air Systems Components, Krueger Div..
 - b. Anemostat Products, Dynamics Corp. of America.
 - c. Carnes Co. Inc..
 - d. E. H. Price.
 - e. Hart & Cooley, Inc.
 - f. Nailor Industries Inc.
 - g. Titus.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Maximum Noise-Criterion Rating: 30 NC.
5. Dampers: Opposed blade.

2.3 REGISTERS

A. Register: See Air Distribution Schedule.

1. Available Products:
 - a. Air Systems Components, Krueger Div..
 - b. Anemostat Products, Dynamics Corp. of America.
 - c. Carnes Co. Inc..
 - d. E. H. Price
 - e. Hart & Cooley, Inc.
 - f. Nailor Industries Inc.
 - g. Titus.
2. Material: Steel.
3. Finish: Baked enamel, white.
4. Maximum Noise-Criterion Rating: 30 NC.
5. Damper Type: Adjustable opposed-blade assembly.

2.4 GRILLES

A. Grille: See Air Distribution Schedule.

1. Available Products:
 - a. Air Systems Components, Krueger Div..
 - b. Anemostat Products, Dynamics Corp. of America.
 - c. Carnes Co. Inc..
 - d. E. H. Price
 - e. Hart & Cooley, Inc.
 - f. Nailor Industries Inc..

g. Titus.

2. Material: Steel.
3. Finish: Baked enamel, white.
4. Maximum Noise-Criterion Rating: 30 NC.
5. Damper Type: Adjustable opposed-blade assembly.

2.5 SOURCE QUALITY CONTROL

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- B. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

END OF SECTION

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

1.3 SUBMITTALS

- A. Product Data: Include dimensions; shipping, installed, and operating weights; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.
- B. Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.
 - 1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
 - 2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
 - 3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air filters and are based on the specific system indicated. Other manufacturers systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. Comply with NFPA 90A.
- C. ASHRAE Compliance: Comply with provisions of ASHRAE 52.1 for method of testing and rating air-filter units.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Provide one complete set of filters for each filter bank.

PART 2 - PRODUCTS

2.1 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:
 - 1. Air Filters and Filter-Holding Systems:
 - a. AAF International.
 - b. Continental Air Filter Div.; NiCon Filter Corp.
 - c. Farr Co.

2.2 EXTENDED-SURFACE, DISPOSABLE PANEL FILTERS

- A. Description: Factory-fabricated, dry, extended-surface filters with holding frames.
- B. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
- C. Media and Media-Grid Frame: Nonflammable cardboard.
- D. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See drawings for additional descriptions and requirements.
- B. Install filter frames according to manufacturer's written instructions.
- C. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- D. Install filters in position to prevent passage of unfiltered air.
- E. Coordinate filter installations with duct and air-handling unit installations.

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components, filter and filter-frame installation, and electrical wiring. Report results in writing.

3.3 CLEANING

- A. After completing system installation and testing, adjusting, and balancing air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

SECTION 23 51 00

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Listed double-wall chimneys.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Type B.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
 - 2. For installed products indicated to comply with design loads, include calculations required for selecting seismic restraints and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

- B. Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.
- C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the manufacturers specified.

2.2 LISTED TYPE B AND BW VENTS

- A. Available Manufacturers:
 - 1. American Metal Products; MASCO Corporation.
 - 2. Metal-Fab, Inc.
 - 3. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
 - 4. Van-Packer Co.
- B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211 and suitable for certified gas-fired appliances.
- C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

- D. Inner Shell: ASTM B 209, Type 1100 aluminum.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
 - 1. Termination: Stack cap designed to exclude 90 percent of rainfall.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- E. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.
- F. Erect stacks plumb to finished tolerance of no more than 1 inch out of plumb from top to bottom.

3.3 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

- B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

END OF SECTION

SECTION 23 55 43

GAS-FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes gas-fired unit heaters.

1.3 SUBMITTALS

- A. Product Data: For each type of fuel-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: For fuel-fired unit heaters. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of fuel-fired unit heaters, as well as procedures and diagrams.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - 3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members to which equipment will be attached.
 - 2. Items penetrating roof and the following:
 - a. Vent and gas piping rough-ins and connections.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For fuel-fired unit heaters to include in emergency, operation, and maintenance manuals.

- F. Warranty: Special warranty specified in this Section.

1.4 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.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within specified warranty period.

- 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GAS-FIRED UNIT HEATERS

- 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:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Lennox Industries, Inc.
 - 2. Modine Manufacturing Company.
 - 3. Reznor/Thomas & Betts Corporation.
 - 4. Sterling HVAC Products; Div. of Mestek Technology Inc.
 - 5. The Trane Co.
- D. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
- E. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.
- F. Type of Venting: Power vented.

- G. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
 - 1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
 - 2. Suspension Attachments: Reinforce suspension attachments at connection to fuel-fired unit heaters.
- H. Heat Exchanger: Aluminized steel.
- I. Burner Material: Aluminized steel with stainless-steel inserts.
- J. Unit Fan: Steel, centrifugal blower fan or propeller fan dynamically balanced and resiliently mounted.
 - 1. Direct-Driven Drive Assembly: Resiliently mounted to housing, with the following features:
 - a. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 - b. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 2. General requirements for motors are specified in Division 23 Section "Motors."
 - a. Motors: Totally enclosed with internal thermal-overload protection and complying with Division 23 Section "Motors."
 - b. 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.
 - c. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
- K. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - 1. Gas Control Valve: Single stage or two-stage. See unit heater schedule.
 - 2. Ignition: Electronically controlled electric spark with flame sensor.
 - 3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
 - 4. Vent Flow Verification: Flame rollout switch.
 - 5. Control transformer.
 - 6. High Limit: Thermal switch or fuse to stop burner.
 - 7. Thermostat: Single-stage, wall-mounting type with 50 to 90 deg F operating range and fan on switch.
- L. Discharge Louvers: Independently adjustable horizontal blades.
- M. Accessories:
 - 1. Unit-mounted control transformer.
 - 2. Remote-mounted 24-volt thermostat with metal tamperguard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and connect gas-fired unit heaters and associated fuel and vent features and systems according to NFPA 54, applicable local codes and regulations, and manufacturer's written installation instructions.
- B. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
 - 1. Restrain the unit to resist code-required horizontal acceleration.
- C. Substrate-Mounted Units: Provide supports connected to substrate. Secure units to supports.
 - 1. Spring hangers and seismic restraints are specified in Division 23 Section "Mechanical Vibration and Seismic Controls."
 - 2. Anchor the unit to resist code-required horizontal acceleration.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to fuel-fired unit heater to allow service and maintenance.
- C. Gas Piping: Comply with Division 23 Section "Fuel Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.
- D. Vent Connections: Comply with Division 23 Section "Breechings, Chimneys, and Stacks."
- E. Electrical Connections: Comply with applicable requirements in Division 26 Sections.
 - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

3.4 ADJUSTING

- A. Adjust initial temperature set points.
- B. Adjust burner and other unit components for optimum heating performance and efficiency.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fuel-fired unit heaters. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

SECTION 23 74 16
PACKAGED, ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following rooftop air conditioners:
 - 1. Packaged cooling and heating units up to 5 tons.

1.3 DEFINITIONS

- A. DDC: Direct-digital controls.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

- B. 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.
- C. Fabricate and label refrigeration system to comply with ASHRAE 23, "Safety Code for Mechanical Refrigeration."
- D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- F. ARI Certification: Units shall be ARI certified and listed.
- G. ARI Compliance for Units with Capacities Less Than 135,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."
 - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."
- H. ARI Compliance for Units with Capacities 135,000 Btuh and More: Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."
 - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."
- I. Units shall be designed to operate with HCFC-free refrigerants.

1.6 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."
- B. Coordinate size, location, roof slope, roof insulation depth, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.
 - 1. Coordinate installation of sound attenuation materials inside roof curb per roof curb details on mechanical drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.

2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
3. Warranty Period for Variable-Speed Fan Motors: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Filters: One set for each filter section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products **by ONE of the manufacturers specified.**

2.2 ROOFTOP AIR CONDITIONERS UP TO 10 TONS

- A. Manufacturers:
 1. Carrier.
 2. Daikin AC (Americas), Inc.
 3. Trane Company (The); Unitary Products Group.
 4. York International Corp.
- B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.
- C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch-thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.
- D. Multi-speed Indoor Fan: Forward curved centrifugal, direct-driven. Fan wheel shall be construction with aluminum fan blades that are continuously welded to the hub plate and end rim. Fan assemblies shall be statically and dynamically balanced at the factory.
- E. Outside Coil Fan: Propeller type, directly driven by permanently lubricated motor.
- F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

- G. Compressor(s): Two speed scroll compressor providing two stage of cooling.
1. Compressor Type: Scroll.
 2. Refrigerant Charge: R-454B (or R-32) with oil.
 3. Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.
- H. Refrigeration System:
1. Compressor(s).
 2. Outside coil and fan.
 3. Indoor coil and fan.
 4. Expansion valves with replaceable thermostatic elements.
 5. Refrigerant dryers.
 6. High-pressure switches.
 7. Low-pressure switches.
 8. Brass service valves installed in discharge and liquid lines.
 9. Charge of refrigerant.
 10. Timed Off Control: Automatic-reset control shuts compressor off after five minutes.
- I. Filters: 2-inch- thick, pleated filters in filter rack for filtration during equipment commissioning. Refer to Division 23 Section “Air Filters” for filters to be installed after commissioning.
- J. Heat Exchanger: Stainless-steel construction for natural-gas-fired burners with the following controls:
1. Redundant dual gas valve with manual shutoff.
 2. Direct-spark pilot ignition.
 3. Electronic flame sensor.
 4. Induced-draft blower.
 5. Two-stage heat.
- K. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.
1. Damper Motor: Fully modulating spring return with adjustable minimum position.
 2. Control: Electronic-control system uses outdoor air-dry bulb temperature.
 3. Relief Damper: Gravity actuated with bird screen and hood.
- L. Power Connection: Provide for single connection of power to unit with and control-circuit transformer with built-in circuit breaker.
- M. Unit Controls: Solid-state control board and components contain at least the following features:
1. Indoor fan on/off delay.
 2. Default control to ensure proper operation after power interruption.
 3. Service relay output.
 4. Unit diagnostics and diagnostic code storage.

5. Field-adjustable control parameters.
 6. Gas valve delay between first- and second-stage firing.
 7. Minimum run time.
 8. Low-refrigerant pressure control.
- N. Digital Thermostat: Seven Day Programmable with auto-changeover and 2-hour manual override button to enable and disable rooftop unit.
- O. Optional Accessories:
1. PVC condensate drain trap.
- P. Roof Curb: Galvanized, steel, insulated with corrosion-protection coating, gasketing, and factory-installed wood nailer; minimum height of 14 inches. See plans and schedules for required curb height to elevate unit above concrete pad with horizontal supply and return configuration.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.
- B. Unit Support: Install unit level on structural curbs. Coordinate roof penetrations and flashing with roof contractor and roof structure.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
 1. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 1. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 23 Section "Duct Accessories."
- D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."

- F. 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 and UL 486B.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
- B. Perform the following field quality-control tests and inspections and prepare test reports:
 - 1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Set economizer operation to open at lowest dry bulb temperature or lowest enthalpy setting (55 deg. F.)
- C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean outside coil and inspect for construction debris.
 - 10. Clean furnace flue and inspect for construction debris.
 - 11. Connect and purge gas line.
 - 12. Adjust vibration isolators.
 - 13. Inspect operation of barometric dampers.
 - 14. Lubricate bearings on fan.
 - 15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 16. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system in summer only.

- b. Complete startup sheets and attach copy with Contractor's startup report.
- 17. Inspect and record performance of interlocks and protective devices; verify sequences.
- 18. Operate unit for an initial period as recommended or required by manufacturer.
- 19. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
 - a. Measure gas pressure on manifold.
 - b. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
- 20. Check calibration of temperature sensors.
- 21. Adjust and inspect high-temperature limits.
- 22. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
- 23. Start refrigeration system and measure and record the following:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outside-air, dry-bulb temperature.
 - d. Outside-air-coil, discharge-air, dry-bulb temperature.
- 24. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
- 25. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Outside-air intake volume.
- 26. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
- 27. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Refer to Division 01 Section "Closeout Procedures".

END OF SECTION

SECTION 23 81 27
DUCTLESS SPLIT-SYSTEM AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes ductless, split-system heat pump units consisting of multiple evaporator-fan units connecting to a single compressor-condenser components. Units are designed for exposed mounting without ductwork.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Diagram power, signal, and control wiring. Refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details per manufacturer's requirements.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- B. 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.
- C. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- D. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Units shall be designed to operate with HCFC-free refrigerants.

1.5 INSTALLERS QUALIFICATIONS

- A. The installing contractor shall utilize factory trained personnel to install and commission the ductless, multi-split system heat pumps.

1.6 COORDINATION

- A. Coordinate size, location, and connection details with equipment pads, roof-mounted mechanical rails, and supports.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.
 - 2. Compressor warranty Period: Six years from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Daikin AC (Americas), Inc.
 - 2. LG Electronics, Air Conditioning Division.
 - 3. Mitsubishi Electric; HVAC Division.

2.2 WALL-MOUNTING, EVAPORATOR-FAN COMPONENTS

- A. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
 - 1. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
 - 2. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2004.
- B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
- C. Fan: Direct drive, centrifugal fan.
- D. Fan Motors: Comply with the following: Special Motor Features: Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
- E. Filters: Permanent, washable pleated.
- F. Factory installed temperature sensor to monitor the space temperature and control the indoor unit via the hard-wired remote controller (thermostat).

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS (HEAT PUMP)

- A. Casing: Steel, finished with baked enamel in manufacturer's standard color, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- B. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Compressor Type: Scroll.
 2. Refrigerant Charge: R-32.
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
- D. Fan: Aluminum-propeller type, directly connected to motor.
- E. Motor: Permanently lubricated, with integral thermal-overload protection.
- F. Low Ambient Kit: Permits operation down to 0 deg F.
- G. Mounting Base: Polyethylene.

2.4 ACCESSORIES

- A. Thermostat: Wall-mounted, hard-wired thermostat to control compressor and evaporator fan, with the following features:
1. Compressor time delay.
 2. 24-hour time control of system stop and start.
 3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 4. Fan-speed selection, including auto setting.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
1. Minimum Insulation Thickness: 1/2 inch
- D. Integral Condensate Lift pump for each evaporator-fan unit.
- E. Accessories:
1. Condensate drain piping: PVC plastic pipe and fittings as indicated on plans.
 2. PVC Plastic drain Materials:
 - a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
 - b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
 - c. PVC Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install pad-mounted, compressor-condenser components on concrete pads. Anchor units to concrete with removable, cadmium-plated fasteners.
- D. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to unit to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 1 Section for Closeout Procedures, Demonstration and Training.

END OF SECTION

INDEX OF ELECTRICAL SPECIFICATIONS

ELECTRICAL DIVISION

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SECTION 26 05 01
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions shall apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Supporting devices for electrical components.
 - 2. Electrical identification.
 - 3. Concrete equipment bases.
 - 4. Cutting and patching for electrical construction.
 - 5. Touchup painting.
 - 6. Ceiling types used and coordination with lighting fixtures.

1.3 SUBMITTALS

- A. The contractor shall provide submittals on the following equipment:
 - 1. Lighting Fixtures (Interior and Exterior)
 - 2. Electrical Panels and disconnects
 - 3. Electrical room layouts based on equipment that will be used on this project.
 - 4. Grounding and Bonding
 - 5. Lighting Controls
 - 6. Wiring devices
 - 7. Conduit, Fittings and Conductor
 - 8. Enclosed Switches & Breakers
 - 9. Transfer Switches
 - 10. Fire Alarm System
 - 11. Data Equipment and Cabling
 - 12. Intercom System
 - 13. Commissioning Pre-functional Checklists (see 266100)
- B. Submittals shall be submitted electronic only (no hard copies).
- C. Submittals shall have the corresponding Specification Section indicated.
- D. Submittals shall have markings/highlighting to indicate selections to be reviewed. Submittal will be rejected if no indications are made.

- E. The review of any submittal and the marking of submittal with “NO COMMENTS” or other markings do not alleviate the need for the contractor to provide all items noted in the contract documents. The contractor must provide all items specified within the contract documents whether included in the submittal or not. Failure to include an item in a submittal does NOT mean that the contractor doesn’t have to provide that item.
- F. **The engineer will review submittals ONE time with ONE resubmittal per section. If the contractor does NOT submit an approvable submittal after these reviews the contractor will be billed at the engineer’s hourly rate (\$200 per hour) for all reviews beyond that point.**

1.4 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.
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
 - 1. **All primary (medium voltage) services modifications will be performed by the Tippah Electric Power Association (Drew Gann 662.837.8139). The contractor will be responsible for total coordination of these services. Pay all cost associated with primary service and transformer. All work must be performed at a time that is coordinated with both the owner and the utility. Any charges for overtime work must be included in bid. It is the contractor’s responsibility for all coordination and to pay all cost associated with this work. Include all charges in bid.**
 - 2. Comply with and provide all requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Section on "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web. Support system shall be selected to suit structural loading.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Expansion Anchors: Carbon-steel wedge or sleeve type.
- G. Toggle Bolts: All-steel springhead type.
- H. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SUPPORT INSTALLATION

- A. Ceiling types used and coordination with lighting fixtures specified shall be done by the contractor prior to ordering fixtures. Provide all the necessary parts, frames, brackets and related items needed for the fixtures specified to mount in the type of ceiling specified by the Architect. This includes, but is not limited to: frames, brackets, and other items needed for gypsum board, lay-in (normal and narrow grid type). There shall be no light leaks or open space between the fixture and frame or grid. This could result in fixtures having to be replaced at contractor's expense, if this isn't done. No change order will be issued for this item.
- B. Install support devices to securely and permanently fasten and support electrical components.
- C. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- D. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- E. Size supports for multiple raceway installations so capacity can be increased by a 25 percent in the future.
- F. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- G. Install minimum 3/8-inch-diameter or larger threaded steel hanger rods, as required for load indicated.
- H. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- I. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- J. Simultaneously install vertical conductor supports with conductors.
- K. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- L. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- M. Install sleeves for cable and raceway penetrations of concrete slabs and walls. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

- N. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
1. Wood: Fasten with wood screws or screw-type nails.
 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 3. New Concrete: Concrete inserts with machine screws and bolts.
 4. Existing Concrete: Expansion bolts.
 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 8. Light Steel: Sheet-metal screws.
 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.3 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Identify raceways by spot painting as follows:
1. Band Locations: At changes in direction, at penetrations of walls and floors, at 25-foot intervals.
 2. Colors: As follows:
 - a. Normal Power: Black.
 - b. Communications: White.
- D. ALL exposed conduits shall be painted (entire length of conduit) with colors outlined above.
- E. Fire Alarm System conduits and boxes shall be RED as specified in Specification Section 283111.
- F. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

3.4 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Section on "Firestopping."

3.5 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.6 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Intercom
 - 6. Data Cabling
 - 7. Fire Alarm
 - 8. Cutting and patching for electrical construction.
 - 9. Touchup painting.

3.7 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Section on "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to paint finishes with matching touch-up coating recommended by manufacturer.

3.8 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 19

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by the contractor acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.
 - 3. General Cable Corporation.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Aluminum conductors are NOT allowed.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THWN and XHHW types (75 degree "C" rated). ALL conductors used must be listed in NEC Table 310.16 (2008) under the 75 degree C temperature rating.
- E. Multiconductor Cable: These are NOT allowed to be used on this project.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Pressure type connectors as manufactured by WAGO are NOT allowed to be used.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper type must be provided – all sizes.
- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Fire Alarm System Cabling: Solid type conductor, stranded conductor may NOT be used on this project.
- D. **Single-Phase Homeruns** The circuits are shown on the drawings as single circuit homeruns. The contractor may combine up to two (2) circuits together into a single homerun. The circuits that are combined must be phase A and phase B. This would mean that a two circuit home-run would include 2 phase conductors (A&B), two neutral conductors (neutrals are not allowed to be shared) and one equipment ground conductor (equipment ground can be shared for the two circuits). It should be noted that this installation is considered to be six (4) current carrying conductors and amp rating of conductors shall be reviewed accordingly. See 2023 NEC Table 310.15(B)(2)(a) for proper adjustments required.
- E. The contractor can NOT combine three phase circuits in the same conduit. He shall also not combine 208V-1ph, 240V-1ph or 480-V-1ph circuits in the same conduit.
- F. **Provide colored conductors for all FEEDER and BRANCH circuits** for 240/120 volt systems as follows:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Neutral (phase A): White with BLACK stripe.
 - 4. Neutral (phase B): White with RED stripe.
 - 5. Ground: Green.
- G. **The contractor MUST use conductors with the jacket color mentioned above. Colored phasing tape on the ends of conductors is NOT acceptable.**

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders (inside): Type THWN, single conductors in raceway.
- B. Exposed Feeders (outside): Type THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN, single conductors in raceway.

- E. Exposed Branch Circuits, Including in Crawlspace: Type THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THWN, single conductors in raceway.
- H. Class 1 Control Circuits: Type THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed conduit or cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible. All exposed conduit must be approved by engineer prior to installation.
- E. Support cables according to Section on "Basic Electrical Materials and Methods".
- F. Identify and color-code conductors and cables according to Section on "Basic Electrical Materials and Methods."
- G. The contractor shall use the next larger conductor for all conductor runs longer than 150'-0".

3.4 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 and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- C. Branch circuit splices shall be made using UL approved wire nuts. Pressure type connectors are NOT allowed. Wire nuts shall be tightened per manufacturer's recommendation and electrical tape shall be applied around wire nut.
- D. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 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 on "Through-Penetration Firestop Systems."

3.6 FIELD QUALITY CONTROL

- A. Testing: Must be done by a qualified person and shall perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Branch circuit grounding.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
- C. Qualification Data: Contractor must be familiar with grounding requirements as outlined in the National Electrical Code.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For grounding to include in operation and maintenance manuals. In addition to items specified in Section on "Operation and Maintenance Data," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems and grounding electrode system.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.4 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 2" X 24" X 1/8" DEEP, with 3/8-inch holes spaced 2" apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 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. All connectors shall be UL rated for grounding use.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts. Bolts must be non-reversing type and UL rated for use with Grounding system.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- 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.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad sectional type; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

- B. Chemical-Enhanced Grounding Electrodes shall not be used.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 12 AWG and smaller, and stranded conductors for No. 10 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG minimum.
 - 1. Bury at least 24 inches (600 mm) below grade.
 - 2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.
- C. Grounding Bus: Install in communications rooms and elsewhere as indicated.
 - 1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
- D. Conductor Terminations and Connections:
 - 1. Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors.
 - 3. Connections to Ground Rods: Welded connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding of Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, non-shrink grout.

3.3 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.
- C. Water Heater, Heat-Tracing, and Anti-frost 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.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. Metal 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.

3.4 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 Rods: Drive rods until tops are 2 inches (50 mm) 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.
 2. For grounding electrode system, install at least three (3) rods spaced at least one and a half rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. 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.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment (grounding electrode system), 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. All connectors must be UL approved for grounding purposes and must be non-reversing type. Where a dielectric main water fitting is installed, connect grounding conductor (GEC) on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end. Bond around all dielectric fittings.
2. Water Meter Piping: Use bonding jumpers to electrically bypass water meters. Connect to pipe with a UL approved non-reversing type bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve to GEC system.

E. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 3/0 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding electrode system.
3. It should be noted that this is a NEC code requirement.

3.5 FIELD QUALITY CONTROL

A. Testing: Engage a qualified person to perform tests and inspections.

B. Perform tests and inspections.

1. Engage a trained representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Provide documentation to the engineer that all connections have been made per code and per these specifications.

C. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 4. Prepare dimensioned drawings locating each ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports and give to engineer.
- F. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 0 thru 100 kVA: 10 ohms.
 2. Pad-Mounted Equipment: 5 ohms.
 3. Manhole Grounds: 10 ohms.
 4. All other items shall be 10 ohms or less – coordinate with engineer.
- G. Excessive Ground Resistance: If resistance to ground exceeds specified values, the contractor shall add additional ground rods and connections until the values mentioned are met.

END OF SECTION

SECTION 26 05 32

RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. NBR: Acrylonitrile-butadiene rubber.
- H. RNC: Rigid nonmetallic conduit.
- I. RSC: Rigid steel conduit

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, cabinets and EZ-Path Fire Stop system.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:

- a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.

1.5 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.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated **rigid steel conduit**.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel.

- G. LFMC: Flexible steel conduit with PVC jacket.
- H. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel compression type.
- I. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Condux International, Inc.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT/Cole-Flex.
 - 11. RACO; a Hubbell Company.
 - 12. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, **Type EPC-80-PVC**, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 BORED RACEWAYS

- A. Bored conduits shall be Schedule 80 HDPE or SDR-11 type
 - 1. Medium Voltage: Black with red strip.
 - 2. Communications: Gray

2.4 METAL WIREWAYS

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

1. Cooper B-Line, Inc.
 2. Hoffman.
 3. Square D; Schneider Electric.
 4. Wiremold
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include 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.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 2. EGS/Appleton Electric.
 3. Erickson Electrical Equipment Company.
 4. Hoffman.
 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 6. O-Z/Gedney; a unit of General Signal.
 7. RACO; a Hubbell Company.
 8. Robroy Industries, Inc.; Enclosure Division.
 9. Scott Fetzer Co.; Adalet Division.
 10. Spring City Electrical Manufacturing Company.
 11. Thomas & Betts Corporation.
 12. Walker Systems, Inc.; Wiremold Company (The).
 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
 14. Quazite
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Metal Floor Boxes: Cast metal fully adjustable, rectangular.
- E. Nonmetallic Floor Boxes: Nonadjustable, round.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

- H. Hinged-Cover Enclosures: 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.
- I. 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION – Power Feeders, Communications Systems and Branch Circuits

- A. OUTDOORS: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit (power and communications systems feeders, branch circuits or workstation communications branch conduit): Vinyl Coated Rigid steel conduit.
 - 2. Concealed Conduit, Aboveground (branch circuits and workstation communications branch conduit): EMT conduit.
 - 3. Concealed Conduit, Aboveground (power and communications systems feeders): Vinyl Coated Rigid steel conduit.
 - 4. Underground Conduit (power and communications systems feeders, branch circuits or workstation communications branch conduit): RNC, Type EPC-80-PVC, must transition to rigid steel (mastic coated) at last 90 degree turn before emerging from ground.
 - 5. Power and communications feeder conduits installed underground or under slab shall be 36" LONG RADIUS rigid type.
 - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 7. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R. Where exposed to wastewater provide stainless steel NEMA 4X.
- B. INDOORS: Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed Power and Communications systems feeders, Not Subject to Physical Damage (above 10'-0" AFF): IMC type.
 - 2. Exposed Power and Communications systems feeders below 10'-0" AFF: Rigid Steel type.
 - 3. Exposed branch circuits and workstation communications branch conduit, Not subject to Physical Damage: EMT type
 - 4. Exposed power feeders, communication systems feeders, workstation communication branch conduit and branch circuits, subject to physical damage: Rigid steel conduit.
 - 5. Power and communications system feeders concealed in ceilings and interior walls and partitions: IMC type.

6. Power and communications feeder conduits installed underground or under slab shall be 36" LONG RADIUS rigid type.
 7. Branch circuits and workstation communication branch conduit concealed in ceilings and interior walls and partitions: EMT type.
 8. Connection to vibrating equipment (Including Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 9. Connection to dry-type Transformers: LFMC.
 10. Damp or Wet Locations: Rigid steel conduit.
 11. Raceways in Spaces Used for environmental return air: see types mentioned above – NO PVC is allowed for this application.
 12. Raceways for risers in Vertical Shafts: see types mentioned above.
- C. Minimum Raceway Size – Power / Lighting: 1/2" trade size.
- D. Minimum Raceway Size – Communications: 1 1/4" trade size.
- E. Minimum Raceway Size – Fire Alarm: 1/2" trade size.
- F. Conduit for voice and data system workstation outlets shall be installed from workstation out to above accessible corridor ceiling. Provide a bushing in the end of communications outlets.
- G. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- H. Aluminum conduit is NOT allowed without specific approval in writing from the engineer.
- I. See "Systems Coordination Schedule" on the drawings for conduit requirements.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 12 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. ALL ELECTRICAL DEVICES SHALL BE INSTALLED IN JUNCTION BOXES. THIS INCLUDES WIRELESS DEVICES. Boxes for switches (wireless and wired) shall be a minimum of 4 11/16" square with single gang plaster ring. The exact size box shall be coordinated with the number of devices required.
- D. Complete raceway installation before starting conductor installation.
- E. Support raceways as specified in Section on "Basic Electrical Materials and Methods."

- F. Arrange stub-ups so curved portions of bends are not visible above the finished slab. All stubs must transition to rigid prior to last 90-degree turn before emerging from slab.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. The maximum conduit in slab shall be 1 ¼" unless special permission is given by structural engineer.
 - 3. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 4. Change from schedule 40 PVC conduit to rigid metal conduit at last 90-degree bend before it emerges from slab. Transition from rigid metal conduit to EMT above finished floor as outlined herein.
- 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. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations 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. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
 - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, 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.
- P. 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.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Flexible whips are not allowed to rest on ceilings. Tie all whips up off ceiling.
- S. ALL conduits that penetrate roofs MUST be coordinated with and comply with the requirements of the roofing contractor's requirements for roof penetrations.

3.3 TRENCHING

- A. Cut the trenches neatly and uniformly.
- B. For Concrete Encased Ducts:
 1. After excavation of the trench, stakes shall be driven in the bottom of the trench at four foot intervals to establish the grade and route of the duct bank.
 2. Pitch the trenches uniformly towards manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts towards buildings wherever possible.
 3. The walls of the trench may be used to form the side walls of the duct bank provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.

4. After the concrete encased duct has sufficiently cured, the trench shall be backfilled to grade with earth.

3.4 BORED RACEWAYS

- A. The contractor is ONLY permitted to bore raceways noted on the contract documents.
 1. ALL borings shall be outside drip lines of trees.
 2. ALL borings shall be 7'-0" deep minimum.
 3. The contractor shall provide all fittings and supports for the transition from bored raceways.
 4. Ducts shall be kept clean of earth, sand, or gravel during construction, and sealed with tapered plugs upon completion of each portion of the work.
 5. Provide mule-tape type pull string in ALL empty conduits.
 6. Provide #10 tracer conductor with all borings.

3.5 EXTERIOR RACEWAY INSTALLATION

- A. Do not use heating blankets or torches to bend conduits. All changes in directions MUST be made with factory fittings.
- B. ALL changes in direction of PVC conduit (under slab or in duct banks) must be made with manufactured fittings. The contractor is NOT allowed to heat and bend PVC conduit.
- C. All conduits in duct banks (with concrete or without) must have pre-manufactured "chairs" with a minimum of 3" spacing between conduits. Provide "Carlon" Snap-N-Stack or approved equal. This applies to under slabs or outside the building.
- D. All changes in direction with PVC conduits must be made with rigid fittings. This applies to outside or under slabs.

3.6 DUCT BANK / CONCRETE ENCASED DUCT

- A. Duct bank concrete shall have 3000 psi mix minimum 28 day compressive strength.
- B. Duct Lines:
 1. Size: Except where otherwise shown on the Drawings, ducts and conduits shall be not less than 6-inch trade size (MV Primary) and 4-inch trade size (Communications).
 2. Concrete encased power ducts shall be Schedule 40 type PVC. Duct shall be suitable for use with 75 degree C rated cables
 3. Manufactured bends shall be not less than 36 inches in radius (long radius) for conduits 4-inch diameter or larger.

- C. Ground wire shall be stranded bare copper No. 2 AWG minimum.
- D. Provide tracer conductor with all borings and duct-banks.
- E. Duct lines shall be in accordance with the NEC, as shown on the Drawings, and as herein specified.
 - 1. Add RED die to concrete for medium voltage primary & secondary.
 - 2. Add ORANGE die to concrete for communications.
 - 3. The contractor must use pre-manufactured chairs at 5'-0" on-center. The pre-manufactured chairs shall be anchored to the floor of the trench with ½" re-bar (driven into the ground) and tied to keep conduits from floating.
- F. Duct shall be sloped to drain towards manholes and **away from building** and equipment entrances. Pitch shall be not less than four inches in 100 feet. Curved sections in duct lines shall consist of long sweep bends with a minimum radius of 50 feet in the horizontal and vertical directions. The use of manufactured bends is limited to building entrances and stub-ups to equipment.
- G. Upon completion of the duct bank installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the line. The mandrel shall be not less than 12 inches long, and shall have a diameter 1/2-inch less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
- H. Duct lines shall consist of single or multiple duct assemblies encased in concrete, and installed with top of duct bank not less than 30 inches below established grade. Ducts shall be uniform in size and material throughout the installation, unless otherwise shown or specified.
- I. Rigid, un-plasticized, polyvinyl chloride spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of three inches above bottom of trench during the concrete pour. Spacer spacing shall not exceed five feet.
- J. Couple the ducts with proper couplings. Couplings shall be staggered in rows and layers to insure maximum strength and rigidity of the duct bank.
- K. The concrete envelope encasing the ducts shall extend not less than three inches beyond the outside walls of the outer ducts and conduits.
- L. Within five feet of pull box wall penetrations, install reinforcing steel bars within the top and bottom of each concrete envelope to provide protection against vertical shearing. Where shown on the Drawings, incorporate steel reinforcing in the duct envelopes.
- M. Ducts shall be kept clean of earth, sand, or gravel during construction, and sealed with tapered plugs upon completion of each portion of the work.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Section on "Through-Penetration Firestop Systems."
- B. Sleeves in fire rated walls shall be EZ-Path fire rated firestops system. Provide model number for the cables to be used PLUS 50% spare capacity. Provide a submittal on this item

3.8 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROLS

PART 1 GENERAL

1.1 SYSTEM TYPE

- A. It should be noted that this project is designed and specified with wireless dimming controls. Hardwired dimming systems will be allowed if ALL devices are provided so that the system will function the same as the wireless system. It will be the contractor's responsibility to provide a complete submittal that will clearly outline that the wired system will operate the same as the wireless system. The vendor will be required to demonstrate the hardwired system to the engineer. The opinion of the engineer will be final.

1.2 SECTION INCLUDES

- A. Digital-network lighting control system and associated components
- B. Wireless Sensors
- C. Load Control Modules
- D. Wireless Control Stations

1.3 REFERENCE STANDARDS

- A. ANSI/ESD S20.20 - Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices); 2014.
- B. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2002a (Reapproved 2010).
- C. CSA C22.2 No. 223 – Power Supplies with Extra-low-voltage Class 2 Outputs; 2015.
- D. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2008.
- E. IEEE 1789 - Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers; 2015.
- F. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- G. ISO 9001 - Quality Management Systems-Requirements; 2008.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- I. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.
- J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2011.
- K. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2010).

- L. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- N. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- O. UL 1310 – Class 2 Power Units; Current Edition, Including All Revisions.
- P. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- Q. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.
- R. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall controls with actual installed door swings.
 - 3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 - 4. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
 - 5. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Pre-Wire Meeting; Lutron LSC-PREWIRE: Lighting Control Manufacturer to conduct on-site meeting prior to commencing work. Manufacturer to review with installer:
 - 1. Low voltage wiring requirements.
 - 2. Separation of power and low voltage/data wiring.
 - 3. Wire labeling.
 - 4. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 - 5. Control locations.
 - 6. Computer jack locations.
 - 7. Load circuit wiring.
 - 8. Network wiring requirements.
 - 9. Connections to other equipment.
 - 10. Installer responsibilities.
- C. Sequencing:
 - 1. Do not install sensors and wall controls until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Design Documents: Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.

- C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
 - 2. Wall Dimmers: Include derating information for ganged multiple devices.
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual installed locations and settings for lighting control system components.
- F. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
- G. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications:
 - 1. Company with not less than ten years of experience manufacturing lighting control products using wireless communication between devices.
 - 2. Registered to ISO 9001, including in-house engineering for product design activities.
 - 3. Provides factory direct technical support hotline available 24 hours per day, 7 days per week.
 - 4. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.
 - 1. Basis of Design System Requirements - Lutron, Unless Otherwise Indicated:
 - a. Ambient Temperature:
 - 1) Lighting Control System Components Electronic Dimming Ballasts: Between 32 and 104 degrees F (0 and 40 degrees C).
 - b. Relative Humidity: Less than 90 percent, non-condensing.
 - c. Protect lighting controls from dust.

1.9 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements. Wireless Sensors: Five years 100 percent parts coverage, no manufacturer labor coverage.
- B. Manufacturer's Standard Warranty, With Manufacturer Full-Scope Start-Up; Lutron Standard 2-Year Warranty; Lutron LSC-B2:
 - 1. Manufacturer Lighting Control System Components, Except Lighting Management System Computer, Ballasts/Drivers and Ballast Modules:
 - a. First Two Years:
 - 1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
 - 2) First-available on-site or remote response time.
 - 3) Remote diagnostics for applicable systems.
 - b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Substitutions:
 - 1. Basis of Design Manufacturer: Lutron Vive was used as the basis of the design for this project. Other manufacturers will be considered; however, they must be submitted to the engineer 10 days prior to bid and they must include this specification with each item within this specification addressed as to how it will be covered. If a substitution is submitted without this will be rejected. The engineer's opinion is final.
 - 2. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by electrical engineer prior to rough-in.
- B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.2 LIGHTING CONTROLS - GENERAL REQUIREMENTS

- A. Sensor Layout and Tuning:
 - 1. Lighting Control Manufacturer to take full responsibility for wired or wireless occupancy/vacancy and daylight sensor layout and performance for sensors provided by Lighting Control Manufacturer.
 - 2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.
 - 3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

- C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- D. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.
- E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
- F. Power Failure Recovery: When power is interrupted for periods up to 10 years and subsequently restored, lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.
- G. Wireless Devices:
 - 1. Wireless device family includes area or fixture level sensors, area or fixture level load controls for dimming or switching, and load controls that can be mounted in a wallbox, on a junction box, or at the fixture.
 - 2. Wireless devices including sensors, load controls, and wireless remotes or wall stations, can be set up using simple button press programming without needing any other equipment (e.g. central hub, processor, computer, or other smart device).
 - 3. Capable of diagnosing system communications.
 - 4. Capable of having addresses automatically assigned to them.
 - 5. Receives signals from other wireless devices and provides feedback to user.
 - 6. Capable of determining which devices have been addressed.
 - 7. RF Range: 60 feet (18 m) line-of-sight or 30 feet (9 m) through typical construction materials between RF transmitting devices and compatible RF receiving devices.
 - 8. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 15, for Class B application.
- H. Wireless Network:
 - 1. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
 - a. Wireless sensors, wireless wall stations and wireless load control devices do not operate in the noisy 2.4 GHz frequency band where high potential for RF interference exists.
 - b. Wireless devices operate in an uncongested frequency band providing reliable operation.
 - c. Fixed network architecture ensures all associated lights and load controls respond in a simultaneous and coordinated fashion from a button press, sensor signal, or command from the wireless hub (i.e. no popcorning).
 - 2. Distributed Architecture: Local room devices communicate directly with each other.
 - 3. Local room devices communicate directly with each other (and not through a central hub or processor) to ensure:
 - a. Reliability of system performance.
 - b. Fast response time to events in the space (e.g. button presses or sensor signals).
- I. Device Finishes:
 - 1. Wall Controls: To be selected by Architect
 - 2. Standard Colors: Comply with NEMA WD1 where applicable.
- J. Interface with building automation system

2.3 WIRELESS SENSORS

- A. General Requirements:
 - 1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
 - 2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
 - 3. Does not require external power packs, power wiring, or communication wiring.
 - 4. Capable of being placed in test mode to verify correct operation from the face of the unit.
- B. Wireless Occupancy/Vacancy Sensors:
 - 1. General Requirements:
 - a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
 - b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
 - d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
 - e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
 - f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
 - g. Color: Selection by Architect. Provided color samples.
 - h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - i. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
 - j. Sensor lens to illuminate during test mode when motion is detected to allow installer to place sensor in ideal location and to verify coverage prior to permanent mounting.
 - k. Ceiling-Mounted Sensors:
 - 1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
 - 2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
 - l. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.
 - 2. Wireless Combination Occupancy/Vacancy Sensors:
 - a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).

- b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).
 - c. Product(s):
 - 1) Ceiling-Mounted Occupancy/Vacancy Sensor; Model LFR2-OCR2B-P-WH: Coverage from 324 square feet (30.2 sq m) to 676 square feet (62.4 sq m) depending on ceiling height from 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view.
 - 2) Corner-Mounted Occupancy/Vacancy Sensor; Model LFR2-OKLB-P-WH; Minor motion coverage of 1225 square feet (113.8 sq m) and major motion coverage of 2500 square feet (232.3 sq m) with mounting height of 6 to 8 feet (1.8 to 2.4 m); 90 degree field of view.
- C. Wireless Daylight Sensors:
- 1. Product: Model LFR2-DCRB-WH.
 - 2. Open-loop basis for daylight sensor control scheme.
 - 3. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
 - 4. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
 - 5. Provide linear response from 2 to 150 footcandles.
 - 6. Color: Selection by Architect. Provided color samples.
 - 7. Mounting:
 - a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
 - b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - c. Provide temporary mounting means for drop ceilings to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
 - 8. Meets CAL TITLE 24 P6 requirements.

2.4 LOAD CONTROL MODULES

- A. Provide wireless load control modules as indicated or as required to control the loads as indicated.
- B. Junction Box-Mounted Modules:
 - 1. Plenum rated.
 - 2. Dimming Modules:
 - a. Product(s):
8A dimming module with 0-10V control; Module Model RMJS-8T-DV-B;
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Single low voltage dimming module with Class 1 or Class 2 isolated 0-10V output signal conforming to IEC 60929 Annex E.2; source or sink automatically configures.

- d. Selectable minimum light level.
 - e. Configurable high- and low-end trim.
 - f. Relay: Rated for 0-10 V ballasts, LED drivers, or fixtures that conform with NEMA 410.
3. Relay Modules:
- a. Product(s):
 - 1) 16 A relay module, without contact closure output; Relay Module Model RMJS-16R-DV-B
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Relay:
 - 1) Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
 - 2) Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - 3) Fully rated output continuous duty for inductive, capacitive, and resistive loads.
4. Luminaire Components:
- a. Wireless fixture control components to be factory-installed in luminaires as indicated on drawings.
 - 1) Wireless Fixture Control Dongle:
 - (a) RF only (no integral sensing capability); Lutron Vive Wireless Fixture Controller; Model DFCSJ-OEM-RF.
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, ten wireless control stations, and one daylight sensor.
 - c. Supports configurable high- and low-end trim.
 - d. Plenum rated in accordance with UL 2043.
 - e. Mounts to fixture through hole.
 - 1) sensor.
5. Digital Bus Interface:
- a. Product: Lutron OEM Digital Bus Interface; Model DFC-OEM-DBI.
 - 1) Provides power for wireless fixture control dongle and up to four LED drivers (60mA at 17-19 VDC).
 - b. DALI compliant.
 - c. UL listed.
6. 20 A Wireless Receptacles
- a. Product(s):
 - 1) 20 A wireless receptacle module,; Model CAR2S-20-DTR.
 - b. Communicates via radio frequency with up to ten compatible occupancy/vacancy sensors, and ten wireless control stations.
 - c. Controlled by associated occupancy/vacancy sensors and wall controls

2.5 WIRELESS CONTROL STATIONS

- A. Product(s):
 - 1. 2-Button Control; Model PJ2-2B
 - 2. 3-Button with Raise/Lower Control; Model PJ2-3BRL

3. 4-Button; Model PJ2-4B
4. Wallbox Adapter; Lutron Model PICO-WBX-ADAPT.
- B. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
- C. Does not require external power packs, power or communication wiring.
- D. Allows for easy reprogramming without replacing unit.
- E. Button Programming:
 1. Single action.
 2. Toggle action.
- F. Includes LED to indicate button press or programming mode status.
- G. Mounting:
 1. Capable of being mounted with a table stand or directly to a wall under a faceplate.
 2. Faceplates: Provide concealed mounting hardware.
- H. Power: Battery-operated with minimum ten-year battery life (3-year battery life for night light models).
- I. Finish: To be selected by Architect

2.6 MAIN UNITS (LUTRON GRAFIK EYE QS)

- A. Product: Lutron GRAFIK Eye QS.
- B. Provide main units with configuration and quantity of zones as indicated or as required to control the loads as indicated.
- C. Finish: Selected by Architect.
- D. Engrave units with button, zone, and scene descriptions as selected by Architect.
- E. Integrated Wireless Capability:
 1. Provide wireless communication inputs for:
 - a. Occupancy sensors.
 - b. Daylight sensors.
 - c. Wireless controller.
 2. RF Range: 30 feet (9 m) between sensor and compatible RF receiving device(s).
 3. RF Frequency: 434 MHz; operate in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
- F. Preset Lighting Control with Zone Override:
 1. Intensity for each zone indicated by means of one illuminated bar graph per zone.
 2. User-programmable zone and scene names.
 3. Utilize air gap off to disconnect the load from line supply.
 4. Astronomical time clock and programmer interface provides access to:
 - a. Scene selections.
 - b. Fade zone to a level.
 - c. Fine-tuning of preset levels with scene raise/lower.
 - d. Lock out scenes and zones.
 - e. Fine-tuning of light levels with individual zone raise/lower.
 - f. Terminal block for wired infrared signal input.
 - g. Enable/disable wall station.
 5. Light intensity with real time energy savings by digital display.
 6. Fade time indicated by digital display for current scene while fading.
 7. Integral wide angle infrared receiver.
 8. For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.

9. Direct Low-Voltage Control of Digital Ballasts and LED drivers (120 V, 220/240 V, 277 V and/or 347 V Lighting):
 - a. Electronically link a digital fluorescent lighting ballast to a zone for both dimming and turning on/off.
 - b. Electronically assign daylight sensors to digital ballasts and line voltage dimmers for proportional daylight harvesting.
 - c. Single integral controller with Class 1 or Class 2 isolated digital output signal conforming to IEC 60929; capable of direct control without interface.
 10. Creates daylighting rows independent of control zones.
 11. Capable of re-zoning without re-wiring using programming display on unit.
 12. Outputs can be virtually mapped to other device's outputs.
 13. Zone raise/lower buttons capable of controlling local lighting loads connected to the main unit or remote lighting zones in the system.
- G. Provides one direct-wired occupancy sensor connection without interface or power pack.

2.7 POWER INTERFACES

- A. Provide power interfaces as indicated or as required to control the loads as indicated.
- B. General Requirements:
 1. Phase independent of control input.
 2. Rated for use in air-handling spaces as defined in UL 2043.
 3. Utilize air gap off to disconnect the load from line supply.
 4. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.
- C. Product(s):
 1. Phase-Adaptive Power Module; Lutron PHPM-PA: Provides interface for phase control input to provide full 16 A circuit output of forward/reverse phase control for compatible loads.
 2. Switching Power Module; Lutron PHPM-SW: Provides interface for phase control or switched input to provide full 16 A circuit output of switching for compatible non-dim loads.
 3. Phase-Adaptive Power Module with 3-Wire Fluorescent/LED Input; Lutron PHPM-WBX: Provides interface for fluorescent ballast/LED driver control input to provide full 16 A circuit output for compatible loads.

2.8 DIGITAL DIMMING AND SWITCHING MODULES (LUTRON ECOSYSTEM)

- A. Provide digital dimming and switching modules as indicated or as required to control the loads as indicated.
- B. General Requirements:
 1. Provide continuous 3-wire signal dimming to compatible 3-wire electronic dimming ballasts.
 2. Utilize air gap off to disconnect the load from line supply.
 3. Connect without interface to:
 - a. Occupancy sensor.
 - b. Daylight sensor.
 - c. Personal control input (wall station or infrared receiver).

4. Generate digital communication commands to distribute ballast and sensor data on the digital bus.
 5. If power is interrupted and subsequently restored, lights automatically return to the setting prior to power interruption.
 6. Each ballast module responds independently to:
 - a. Up to 32 occupancy sensors.
 - b. Up to 64 personal control inputs.
 - c. Two daylight sensors.
 7. Unique internal reference number visible displayed on module cover.
 8. Averages two independent daylight harvesting inputs internally.
 9. Responds to digital load shed command.
 - a. Sets high end trim.
 - b. Automatically scales light output proportional to load shed command.
(Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast to automatically set the maximum light output at 90 percent and lower current light output by 3 percent to 27 percent).
 10. Provide integral fault protection to prevent ballast module failure in the event of a miswire.
- C. Product(s):
1. 3-Wire Ballast Module, 16 Amp; Lutron EcoSystem Model C5-BMJ-16A:
 - a. Integrates up to 16 amps of 3-wire electronic dimming ballasts into EcoSystem digital control system as a single zone.
 - b. Integrates up to 16 amps of switched high intensity discharge (HID) lighting load into EcoSystem digital control system as a single zone.

2.9 SOURCE QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Factory Testing; Lutron Standard Factory Testing:
 1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
 2. Perform full-function factory testing on 100 percent of all ballasts and LED drivers.
 3. Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130
- B. Install products in accordance with manufacturer's instructions.

- C. Sensor Locations:
 - 1. Locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 - 2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.
- D. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Manufacturer's Full-Scope Start-Up Service
- C. Manufacturer's Programming Service:
 - 1. Product(s):
 - a. On-site programming
- D. Manufacturer's Full-Scope Start-Up Service:
 - 1. On-Site Full-Scope Start-Up Service; Lutron LSC-OS-SU-VIVE: Manufacturer's authorized Service Representative to conduct site visit upon completion of lighting control system installation to perform system startup and verify proper operation:
 - a. authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 - b. Verify connection of power wiring and load circuits.
 - c. Verify connection and location of controls.
 - d. Associate occupancy/vacancy sensors, daylight sensors, wireless remotes, and wall stations to load control devices.
 - e. Program timeclock schedules per approved sequence of operations.
 - f. Configure load shed parameters per approved sequence of operations.
 - g. Verify system operation control by control.
 - h. Obtain sign-off on system functions.
 - i. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
- E. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.4 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.

- C. Demonstration:
 - 1. Demonstrate proper operation of lighting control devices to electrical engineer and owner. Correct deficiencies or make adjustments as directed.
 - 2. On-Site Performance-Verification Walkthrough for lighting control manufacturer to provide on-site demonstration of system functionality to electrical engineer and owner
- D. Training:
 - 1. Include services of manufacturer's certified service representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of on-site system start-up services.

3.6 MAINTENANCE

- A. See Section 01 7000 – Execution and Closeout Requirements, for additional requirements relating to maintenance service.

3.7 PROTECTION

- A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. SPD: Surge Protection Device.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

- C. Qualification Data: For qualified testing agency.
- D. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section on "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding **23 deg F (minus 5 deg C)** to plus 104 deg F (plus 40 deg C).
 - b. Altitude: Not exceeding 5000 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 5000 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect and Owner no fewer than 14 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's written permission.
3. Comply with NFPA 70E.

1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26.

B. Enclosures: Flush- and surface-mounted cabinets – see panel schedules.

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.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. **DOOR-IN-DOOR COVER WITH TWO LATCHES:** Entire front trim hinged to box and with a second hinge to access terminations. A front hinged to box panel with one latch is NOT acceptable. There shall be two sets of hinges, one to access breakers only (dead-front design) and one to access terminations. Each hinge shall have a lockable latch (one minimum per hinge) to access that portion of the electrical panel.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Same finish as panels and trim.
7. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top or bottom as required.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

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.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers 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: Series rated devices are NOT allowed.
- I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- J. When two-section panelboards are used, BOTH SECTIONS must be the same physical size.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or Main Lugs only.
- D. Branch Overcurrent Protective Devices: **Bolt-on** circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike. Provide door-in-door type.
- F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. 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.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. 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. Shunt Trip: 120 or 24 -V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.4 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Section on "Basic Electrical Materials and Methods "
- C. 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.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- H. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section on "Basic Electrical Materials and Methods."
- B. Create a directory to indicate installed circuit loads **after balancing panelboard loads**; incorporate 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 on "Basic Electrical Materials and Methods."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection 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.
3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section on "Overcurrent Protective Device Coordination".
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.7 THERMAL SCANS OF ELECTRICAL PANELS

- A. The contractor shall employ a 3rd party contractor to performed a thermographic survey on the project. The IR Scan shall be performed by an experienced technician using a Mikron TH5104 Thermal Imaging Camera or approved equal. During the scan excessive temperature rises, if any, shall be identified. Abnormal heat differences with respect to a similar device or an adjacent phase(s) shall be recorded. Thermograms and digital images shall be included in a report to the engineer. The probable cause(s) of the temperature rise and recommended corrective action(s) shall be included for each set of images. When scheduling repairs, remember that heating problems worsen by increases in ambient temperatures and loading. An index of equipment scanned shall be included in the report to the engineer. This serves as a checklist for the scope of work performed.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Communications outlets.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. SPD: Surge Protection Device.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. 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.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.
 - 2. It shall be the contractor's responsibility to coordinate the correct male or female connections – provide accordingly.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Provide two (2) of each type provided on the project.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All 20A/1P receptacles in this project shall be tamper resistant type.

2.2 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; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.3 STRAIGHT BLADE RECEPTACLES

- A. Tamper Resistant Receptacles, 125 V, 20A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; TR5351 (single), TR5352 (duplex).
 - b. Hubbell; HBL5351TR (single), CR5352TR (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.4 GFCI RECEPTACLES

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Tamper Resistant Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; GFTR20.
 - b. Pass & Seymour; 2084TR.

2.5 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

- c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
- d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.7 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Satin-finished stainless steel 0.04-inch- (1-mm-) thick.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.8 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to ensure that devices and their boxes are protected. 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 the 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 just 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. Pig-tailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they 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 (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Tighten unused terminal screws on the device.
7. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
8. Provide a minimum of one wrap of electrical tape around electrical connections.

E. Backbox Mounting:

1. Mount backbox to telescoping screw-gun bracket that extends from stud to stud.
2. Bracket equal to Erico. Contractor to determine size and width.

F. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles **UP**, and on horizontally mounted receptacles to the **LEFT**.

G. Device Plates: Use medium size device plated. Repair wall finishes and remount outlet boxes when device plates do not fit flush or do not cover rough wall opening.

H. 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.

- I. 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.
- J. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Section on "Basic Electrical Materials and Methods."
 - 1. Receptacles: Identify panelboard and circuit number from which served. See drawings for detail.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Use receptacle tested that shows ground, neutral and proper connectivity.
- B. Tests for Convenience Receptacles – to be performed by the contractor provide report in O&M manuals:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of over 5 percent is not acceptable and the conductor must be changed to the next larger size.
 - 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. The 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.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Enclosed circuit breakers.
 - 2. Fusible switches.
 - 3. Non-fusible switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- 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.

C. Qualification Data: For qualified testing agency.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section on "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. 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.

D. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

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

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single or Double Throw: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses as required for load served, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit (if required): 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: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.
6. Accessory Control Power Voltage: Remote mounted and powered as required.

2.2 NONFUSIBLE SWITCHES

A. 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 limit to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single or Double Throw: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Lugs: **Mechanical** type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, **provide products by one of the following:**

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

- C. 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.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- F. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- G. Use HACR type breakers to serve all outdoor mechanical equipment.
- H. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, 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. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.4 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install 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 on "Basic Electrical Materials and Methods."
- 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.

3.3 IDENTIFICATION

- A. Comply with requirements in Section on "Basic Electrical Materials and Methods "
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection 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.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 26 36 00

TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
 - 1. Non-automatic (manual) transfer switches.
 - 2. Remote annunciation systems.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
 - 1. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. 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.
- C. Comply with NEMA ICS 1.
- D. Comply with NFPA 70.
- E. Comply with NFPA 99.
- F. Comply with NFPA 110.
- G. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Contactor Transfer Switches:
 - a. Caterpillar; Engine Div.
 - b. Emerson; ASCO Power Technologies, LP.
 - c. Generac Power Systems, Inc.
 - d. GE Zenith Controls.
 - e. Kohler Power Systems; Generator Division.
 - f. Onan/Cummins Power Generation; Industrial Business Group.
 - g. Russelectric, Inc.
 - 2. Transfer Switches Using Molded-Case Switches or Circuit Breakers are NOT allowed.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- E. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.
- F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching.
- A. **Neutral Switching. Neutral pole shall NOT be switched.**
- B. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- C. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations.
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
- D. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 NONAUTOMATIC (MANUAL) TRANSFER SWITCHES

- A. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- B. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.
- C. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.
- D. Source 1 is to be a lugged to accommodate feeders on each building Electrical Riser for permanent connection.
Source 2 is to be a cam-loc connection for temporary connection during generator servicing or outage conditions.
- E. Nonautomatic Transfer-Switch Accessories:
 - 1. Pilot Lights: Indicate source to which load is connected.
 - 2. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternate-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."
 - 3. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

2.4 SOURCE QUALITY CONTROL

- A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

PART 3 - EXECUTION

3.1 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. After installing equipment and after electrical circuitry has been energized, test 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.
 - 3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
 - 4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to non-automatic transfer switches and of emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
- C. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

- D. Remove and replace malfunctioning units and retest as specified above.
- E. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.3 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTION DEVICE (SPD)

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. SPD for electrical power service at the Main Branch Panel.

1.2 SUBMITTALS

- A. Submit under provisions of Section 26000.
- B. Submit shop drawings of catalog data with complete description of materials and performance data.
- C. Submit a single impulse surge current test report issued by a nationally recognized testing facility & an ANSI/IEEE Category C3 (20KV, 10KA) life cycle test report. The test reports should demonstrate that each SPD unit could withstand, in its installed configuration, the specified values (up to 200K transient amps per mode) without failure of any internal component (MOVs, wiring, printed circuit board, fusing and disconnect).

1.3 COMPLIANCE REQUIREMENTS

- A. Listed to UL 1449, Third Edition – Type 1 SPD
- B. Listed to UL 1283 listing for EMI/RFI filters

1.4 ACCEPTABLE VENDORS

- A. Current Technology
- B. Liebert

PART 2. PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Raceway and Fittings: Rigid steel conduit as specified in other sections.
- B. Wire & Cable: Single conductor Type THHN, stranded copper, as specified in other sections.
- C. SPD for Main Switchboard: SPD shall protect in all seven modes for a wye configuration (L-N, L-G, all phases & N-G). Tested surge current capacity of 80,000 amps per protection mode. SPD shall be equal a Current Technology Model CGP3-80. If a breaker is not specified in the panel, provide a 60A/2P breaker with 4#6 connection.
- D. Each SPD unit shall be capable of surviving at least the following Category C3 (20KV, 10KA) impulses without failing or degrading the UL 1449, Third Edition VPR more than 10%:

Distribution Panel	5,500 impulses
Branch Panel	4,000 impulses

- E. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method - Up to 33 dB from 10 KHz to 100 MHz.
- F. Diagnostic Monitoring System: The SPDs shall include the Current Technology Diagnostic Monitoring System. It includes an audible alarm system, Form C Contacts, phase indicator smart lights, which change color based upon percentage of protection remaining., and the ability to field test for the condition of protection.

2.2 WARRANTY

- A. The SPD system shall have a FIFTEEN-YEAR limited product warranty from date of shipment against transient failure, when installed in compliance with applicable national/local electrical codes and manufacturer's installation manual.

PART 3. EXECUTION.

3.1 INSTALLATION

- A. Install in strict accordance with the manufacturer's printed instructions.
- B. Have a factory-authorized representative inspect installation and verify that the SPD is working to factory specifications before building final inspection.
- C. The contractor shall fire seal all raceway openings between each SPD and the electrical gear it is protecting to prevent any air born particles from migrating to the electrical gear.
- D. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. **The contractor shall be responsible with coordinating with reflective ceiling plans and providing all the necessary frames and related items as required for the mounting of the fixtures per contract documents. Include ALL cost associated with this in the cost of this project. NO CHANGE ORDER will be processed for fixture modifications.**

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior lighting fixtures.
 - 2. Emergency lighting units.
 - 3. Exit signs.
- B. Related Sections:
 - 1. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.
- F. LED: Light Emitting Diode

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
1. Physical description of lighting fixture including dimensions.
 2. Emergency lighting units including battery and charger.
 3. Energy-efficiency data.
 4. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Mechanical Division on Section "Diffusers, Registers, and Grilles."
 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
 - b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Installation instructions.
- D. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting fixtures.
 2. **Grid type and mounting system – provide based on type of grid provided by the Architect – narrow grid may take special parts / frames installed by the factory on some fixtures. Clips that allow a gap around the fixture is NOT acceptable and will be rejected if installed in the field.**
 3. Suspended ceiling components.
 4. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
 5. Ceiling-mounted projectors.
 6. Structural members to which suspension systems for lighting fixtures will be attached.
 7. Other items in finished ceiling including the following:

- a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.
- G. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.
- 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 application.
- C. Comply with NFPA 70.
- D. LED Fixtures:
 - 1. UL and/or ETL Listed
 - 2. All light fixture components shall be IESNA LM-79-2008 Rated
 - 3. All LEDs shall be IESNA LM-80-2008 Rated interpreted per IESNA TM-21.
 - 4. EnergyStar Compliant – When Specified
 - 4. DLC (DesignLights Consortium) Qualified – When Specified
 - 5. Lighting Facts Listed – When Specified

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. The first year will include parts and labor. After the first year this shall include material only.

B. Warranty for Lighting Fixtures:

1. Provide a written 5-year replacement warranty (materials only) and provide a 1-year onsite replacement warranty (materials and labor) for defective fixtures, non-starting power supply units, and LED source assemblies, which include, but are not limited to, LED packages, LED arrays, LED modules, LED dies, encapsulates, and phosphors.
 - a. LEDs shall be minimally rated at L80 unless otherwise specified.
 - b. Interior Fixtures including the LED Driver, LED Array and all associated components shall be minimally rated for 50,000 hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, **provide product indicated on Drawings in the Lighting Fixture Schedule – OR as approved equal.**

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. LED Fixtures:
 1. Submitted light fixtures shall match specified drive current and lumen output.
 2. Submitted light fixture CRI shall be equal to or greater than the CRI specified.
 3. Binning: Per ANSI, 3-step MacAdam Ellipse or greater
 4. Fixtures shall offer 0-10V dimming or digitally addressable driver: Specified lighting control manufacturer shall serve as a basis of design on a per project basis.
 5. Housing, LED driver, and LED module shall be provided by the same manufacturer.
 6. Photometric data shall be included for all fixtures.
 7. Interior calculations, when requested, shall include all summary data including uniformity ratios.
- B. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- F. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- a. Lens Thickness: At least 0.125 inch (3.175 mm) – 8 oz per sqft.
- b. UV stabilized.

- G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:
 - a. CCT and CRI for all luminaires.

2.3 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.
 - f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
 - g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

3. Master/Remote Sign Configurations:

- a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply ballast for power connection to remote unit.
- b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power

requirements from master unit. Connect for testing concurrently with master unit as a unified system.

- C. Provide universal mounting hardware for all exit signs

2.4 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.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods " for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) 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 gauge.
- E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
 - 2. Install lamps in each luminaire.
- B. Ceiling types used and coordination with lighting fixtures specified shall be done by the contractor prior to ordering fixtures. Provide all the necessary parts, frames, brackets and related items needed for the fixtures specified to mount in the type of ceiling specified by the Architect. This includes, but is not limited to: frames, brackets, and other items needed for gypsum board, lay-in (normal and narrow grid type). There shall be no light leaks or open space between the fixture and frame or grid. This could result in fixtures having to be replaced at contractor's expense, if this isn't done. No change order will be issued for this item.
- C. Provide #14 AWG conductor in fixture whips. Fixtures with 0-10V drivers must be provided with whips that include the 0-10V conductors.
- D. Where fixtures and controls for a space are specified to have low-voltage controls of any type, the related lighting circuit must be provided with control wiring as required to permit full operation and control of the fixture(s) from the control(s).
- E. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- F. Remote Mounting of Driver: Distance between the driver and fixture shall not exceed that recommended by driver manufacturer. Verify, with driver manufacturers, maximum distance between ballast and luminaire.
- G. Lay-in Ceiling Lighting Fixtures Supports: Do not use grid as a support element.
 - 1. Install ceiling support system rods or wires, **independent of the ceiling suspension devices**, for each fixture (1 at each corner of fixture, 4 total per fixture).
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

- 5. The contractor shall pay close attention to the type of lay-in ceiling grid that is specified by the Architect and provide fixtures that will match and be compatible with the grid. This may take a special frame for the fixtures. The fixtures MUST fit the grid without any gaps around the fixture. No change orders will be processed.**

H. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), 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.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Electrical Identification."

3.3 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.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 26 61 00
ELECTRICAL SYSTEMS COMMISSIONING

PART 1 – GENERAL

1.1 DESCRIPTION

- A. General provisions and other electrical systems are specified in other Sections of Division 26.
- B. This Section covers electrical systems commissioning to make the systems ready for safe and satisfactory operation within the design intent. Commissioning shall include, but shall not be limited to, identification, cleaning, documentation, preparation of maintenance and operation manuals, training, preparation of record drawings, lubrication, start-up, check-out, and testing and adjusting of systems.
- C. Commissioning shall be performed throughout construction. Equipment start-up shall be documented as specified herein. Commissioning of the electrical systems shall include the pre-functional and functional performance testing specified herein.

1.2 QUALITY ASSURANCE

- A. Electrical systems commissioning shall be the responsibility of the contractor. The engineer will review all findings and make recommendations for changes.
- B. The contractor shall review submittal data for conformance with the requirements of the Project, shall monitor compliance with the requirements specified herein for storage and protection of equipment during construction, shall authorize the initial starting of equipment and systems in a manner to avoid damage to equipment, shall start-up, test and adjust equipment as required.
- C. Refer to ASHRAE Guideline 1-2007, The HVAC Commissioning Process, and Guideline 4-2008, Preparation of Operating and Maintenance Documentation for Building Systems.

1.3 SUBMITTALS

- A. As specified in Section 260501, Electrical General and other sections of Division 26.

PART 2 – PRODUCTS

2.1 IDENTIFICATION MATERIALS

- A. Conduit markers: As indicated in the specifications.
- B. Signs: As indicated in the specifications.

C. Nameplates and Labels:

1. White core plastic laminate with engraved lettering for normal systems and red core plastic laminated with engraved lettering for emergency systems.
2. Nameplates for individual devices shall have 0.25" high letters.
3. Nameplates for panelboards, circuit and motor disconnects, and equipment shall have 0.5" high letters.
4. Labels shall have minimum 0.25" high letters.

PART 3 – EXECUTION

3.1 CLEANING

A. Equipment and Equipment Rooms:

1. Remove dust, dirt, rust, stains, and temporary covers.
2. Foreign matter shall be blown, vacuumed, flushed, or cleaned out of and from equipment, fixtures, raceways, devices, switches, controls and panelboards.
3. Clean and polish identification plates.
4. In equipment rooms, clean equipment, conduit, and room surfaces from dust and dirt and maintain in a clean condition from date of substantial completion until final completion of work and corrective work.

3.2 IDENTIFICATION

A. General:

1. Identification shall consist of upper-case letters.
2. Where identification is applied to surfaces which require a finish, identification shall be installed after surface has been finished.

B. Conduit Markers:

1. Install on conduits and raceways exposed or above ceilings at connections to junction boxes, pull boxes, equipment, each side of wall, floor, and roof penetrations, and at 50' intervals along straight runs.
2. On parallel conduits (grouped), markers shall be placed on each conduit in line with each other. Markers shall be positioned in such a manner as to ensure visibility.

C. Box identification: identify in indelible marker, branch circuit panel and circuit numbers for branch circuits contained within each outlet box, and on the cover of each box. Label on cover shall be P-Touch label.

D. Cable identification: install cable identification on each communication or signal cable.

E. Nameplates and Labels:

1. Install engraved nameplates at or on each circuit breaker, circuit and motor disconnect, panelboard unless equipment is specified herein with its own self-explanatory identification. Text shall match terminology and numbering of the construction documents and submittals as close as practicable, and shall indicate equipment controlled as well as upstream distribution device and branch circuit or feeder designation.
 2. Nameplates shall not cause interference with operation and maintenance of equipment. Attach nameplates with rustproof screws.
- F. Panelboards: install type written directories describing the load served by each circuit. Identify spaces and spares. Install on back of panelboard doors.

3.3 OPERATION AND MAINTENANCE DOCUMENTATION PACKAGE

- A. Six copies of operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and diskettes, shall cover the electrical systems. Documentation shall include the following: operations and maintenance documentation directory; emergency information; operating manual; maintenance manual; test reports; and construction documents.
- B. The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner 2 months after submitting and before systems start-up and commissioning, and shall be updated, revised and completed during, and at completion of, commissioning.
- C. Documentation shall be typewritten and shall contain, at a minimum, the following information.
 1. Introduction:
 - a. Project name, contractors' and subcontractors' names, addresses, and telephone and facsimile numbers.
 - b. Index.
 2. Operations and Maintenance Documentation Directory:
 - a. Explanation of the identification system used, including lists of systems, equipment and component identifiers and names.
 3. Emergency Information:
 - a. Information for technical and nontechnical personnel about actions recommended during emergency situations to protect life and property and to minimize disruption to the building occupants. Emergencies shall, at a minimum, include:
 - 1) Power failure.
 4. Operating Manual:
 - a. General Information:
 - 1) Building function.
 - 2) Building description.
 - 3) Operating standards and logs.
 - 4) Submittals

- 5) Engineer's submittal comments.
- 6) All job observation reports along with contractor's response that all items have been completed.
- b. Technical Information (All systems specified):
 - 1) System description.
 - 2) Operating routines and procedures.
 - 3) Special procedures.
 - 4) Basic troubleshooting.
- 5. Maintenance Manual (All systems specified):
 - a. Descriptions (specifications) of the equipment and components.
 - b. Description of function, as applicable: the function of the equipment, procedures before start-up, functional parameters (input, output) at the design load and at part loads, and performance verification procedures.
 - c. Recommended maintenance procedures and their recommended frequency for this Project.
 - d. Recommended list of spare parts, part numbers, and the place(s) from which they can be obtained.
 - e. Original purchase order number; date of purchase; name, address, and the telephone number of the vendor; and warranty information.
 - f. Installation information.
 - g. Any other information needed for the preparation of documents supporting the management of operation and maintenance programs.
- 6. Test Reports and Certifications:
 - a. Copies of tests and certifications performed during manufacture, construction, and commissioning, including, but not limited to the following:
 - 1) Overcurrent protective device coordination study.
 - 2) Certification of fire alarm system operation.
 - 3) Receipt of O&M documentation package.
 - 4) Receipt for instruction of operating personnel.
 - 5) Ground resistance test.
 - 6) Fire alarm system test report.
- 7. Construction Documents:
 - a. Record drawings (as built drawings)
 - b. Approved submittals, including revised shop drawings indicating field and as-installed conditions.
 - c. Equipment identification charts and schedules.
 - d. Warranty certificates.
 - e. Inspection certificates.
 - f. Commissioning report (pre-functional and function tests).
- D. Submit a receipt signed by the Architect acknowledging receipt of the operation and maintenance documentation package.

3.4 RECORD DRAWINGS

- A. Concurrent with the Architect/Engineer's final certificate, submit 2 sets of prints indicating field and as-installed conditions of equipment, systems, conduit and raceways, and incorporating changes made during construction.
- B. A record of field and as-installed conditions shall be maintained at the site, shall be kept current throughout the Project, and shall be used in the preparation of the final record drawings.
- C. Record drawings shall, as a minimum, include:
 - 1. The manufacturer and model number of each piece of equipment.
 - 2. Equipment location and orientation.
 - 3. Raceway and cable tray locations and sizes.
- D. Reproductions of design drawings shall not be used in the preparation of record drawings.

3.5 MAINTENANCE

- A. Equipment operated prior to the date of the Architect's final certificate shall be maintained in accordance with manufacturers' recommendations.

3.6 INSTRUCTION OF OPERATING PERSONNEL

- A. Conduct formal instruction sessions for operating personnel. Conduct two similar sessions. The first session shall be conducted at the time of start-up and check-out, and the second session shall be approximately 1 month later. Sessions shall be a minimum of twelve hours in duration for basic electrical systems, and as specified herein for other systems and equipment. Sessions shall be conducted at the site.
- B. Prepare and submit a syllabus describing an overview of the program, describing how the program will be conducted, when and where meetings are to be held, names and company affiliations of lecturers, description of contents and outline for each lecture, and recommended reference material and outside reading. Obtain direction from the Owner on which operating personnel shall be instructed in each system.
- C. Sessions shall include:
 - 1. General familiarization and operating procedures for the entire electrical installation.
 - 2. Routine maintenance procedures for equipment.
 - 3. Specific operating and maintenance procedures for:
 - a. Electrical panels

- D. Factory-trained technicians shall give operating and maintenance instructions on the following systems and equipment:

<u>System/Equipment</u>	<u>Minimum Session Duration, hours</u>
Electrical panels & distribution	2
Transfer Switches	2
Fire Alarm System	4

- E. Provide DVD format disks of training sessions. Training sessions to be taped by contractor.
- F. Obtain receipt acknowledging completion of each item of instruction.

3.8 EQUIPMENT START-UP AND FUNCTIONAL PERFORMANCE TESTS

- A. General: The engineer shall review and approve the Contractor's documentation for the preparation and check-out of equipment for initial start-up. The contractor shall conduct and document the functional performance tests to demonstrate the proper installation, operation and performance of installed equipment and systems. Complete documentation of this testing shall be submitted to, and accepted by, the engineer prior to substantial completion. This documentation shall include the verification of readiness for start-up of each item of equipment on the basis of inspection, including:
1. Adjustment of electrical equipment.
 2. Equipment properly set.
 3. Wiring and equipment properly connected.
 4. Controls, safeties, and time switches properly set.
 5. Electrical overload relays appropriate for load.
 6. Electrical accessories properly installed and adjusted.
- B. Prior to energizing, test cables and wire for continuity, shorts, and circuitry, and correct short circuits, opens, and errors in circuiting.
- C. Over-current Protective Device Coordination Study:
1. Set field-adjustable devices to dial and tap settings as approved by the engineer.
 2. Prior to energizing over-current protective devices, test devices for continuity of circuitry and for short circuits. Correct malfunctioning units.
 3. The contractor shall provide a selective coordination study of all adjustable breakers for the engineer to review during the submittal stages of this project.
- D. Prepare first-run checklist for equipment, perform first-run observations and record findings.
1. Verify direction of motor rotation after final electrical connections.
 2. Measure ampere draw of electric motors and compare with nameplate rating and with overload heater ratings.
- E. Start-up equipment and check-out operation in accordance with manufacturer's published procedures and with the procedures specified herein.

1. Submit report on equipment start-up and check-out with data from recorded findings.

F. Electrical Panels and related equipment:

1. After complete installation, the contractor shall test the following items as a minimum:
 - a. Check for tightness of bolted connections.
 - b. Check for bus bar bracing.
 - c. Check that contact and joint resistances in circuit breakers are within manufacturer's tolerances.
 - d. Check for installation and connection of equipment and circuits, and calibration or adjustment of meters, relays, remote controls, and other devices to ensure operation.
 - e. Test to determine that circuit breaker trip devices are operating and adjusted.
2. The engineer reserves the right to witness the above-described tests, checks, and inspections. Notify the engineer at least 10 days prior to the date scheduled for the tests.

G. Grounding:

1. Ground resistance shall be measured by the contractor in accordance with IEEE 81-1983. Measurements shall be made with the grounding system isolated from the utility neutral. Results of the tests shall be submitted in a test report. The certified test report shall include the following minimum data:
 - a. Project name, date and location of test.
 - b. Instrument serial number and type used.
 - c. Sketch, showing layout of ground system and locations of test spikes.
 - d. Measured ground resistance.

3.9 COMMISSIONING VERIFICATION

- A. Prior to the engineer coming to the site for commissioning verification, the contractor shall provide the following:
1. (ALL systems): The contractor MUST provide his punch-list where he has been through the system and has verified that all items are working properly. This list shall include ALL items that he found along with a signature and date that each item was completed.
 2. (Fire Alarm System Only): Provide a letter signed by the fire alarm vendor that he has tested the fire alarm system and ALL items meet the contract documents and NFPA72.
 3. (Fire Alarm System Only): Provide documentation from the fire alarm vendor that outlines the testing of EVERY smoke detector. This document must list that each device either PASS or FAIL. Any device that didn't PASS must be replaced and the new device tested.
 4. (Fire Alarm System Only): No TROUBLES or ALARMS shall be present on control panel.
- B. Make the following available to the Engineer for commissioning verification:
1. Electrician with hand tools.
 2. Voltmeter, 1% accuracy.
 3. Clamp-on ammeter.
 4. Submittals.

5. Complete specifications and drawings with bulletins, addenda and revisions.

**ITEMS NEEDED FOR SUBSTANTIAL COMPLETION OBSERVATION BY ENGINEER
ELECTRICAL DIVISION**

PROJECT:			FIELD REPORT NO: Ready for Substantial Completion
CLIENT PROJECT NO:			CLA PROJECT NO:
DATE:	TIME: N/A	WEATHER: N/A	TEMP RANGE: N/A
SUBMITTED BY: Keith Bryant, PE (<i>Electrical Engineer</i>)			
The following items MUST be completed and ALL reports back to the engineer one week prior to scheduling Substantial Completion site observation. ELECTRICAL ITEMS: ☐ 1. ALL electrical division contractors MUST submit their job site inspection report listing all items found defective. Each of these items MUST be marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 2. All prior Field Observation Reports by the engineer MUST be submitted back to the engineer with all items marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 3. All Pre-Functional Checklists (furnished by the contractor / supplier) must be completed and submitted back to the engineer with all items marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 4. All Checklists performed by systems vendor must be completed and submitted to the engineer with all items marked COMPLETED along with the signature and date of the person completing each item. _____ Completed ☐ 5. The following people MUST be present at substantial completion observation by the engineer: ☐ All electrical division contractors ☐ Fire Alarm System Tech ☐ Vendor / Installers of electrical division systems that can demonstrate that the equipment is working properly. _____ Completed ☐ 6. The electrical division contractors must have the following items on hand for the Substantial Completion Site Observation: ☐ Six-foot stepladder ☐ Flashlight ☐ Two radios for communicating ☐ Amp & Volt Meter ☐ Contract documents (plans, specs & submittals)			

☐ _____ **Completed**

GENERAL ITEMS:

1. Electrical division contractors must have the following items on hand for review at the time of the substantial completion site observation by the engineer:

- ☐ “As-Built” drawings
- ☐ O&M Manuals

_____ **Completed**

2. Electrical division contractors shall understand that training will NOT happen on equipment until the engineer has reviewed equipment / systems and they are found to be in proper working order. Once the engineer as determined that the equipment / systems is ready for training, the owner (school system) must be given a minimum of one week’s notice.

_____ **Completed**

3. The electrical division contractors shall sign below stating that ALL items required under the scope of division #26 and #27 have been provided / installed and is in proper working order. The signature below also states that ALL items provided under Division #26 have been tested and are in proper working order.

_____ **Electrical Division Contractor’s Signature of Completion**

_____ **Date of Signature**

SPECIAL NOTE:

IF ALL ITEMS MENTIONED ABOVE ARE NOT COMPLETED AND THE CONTRACTOR SCHEDULES A SUBSTANTIAL COMPLETION SITE REVIEW WITH THE ENGINEER, THE ENGINEER WILL BE COMPENSATED BY THE CONTRACTOR AT CLA RETAIL RATES FOR EACH ADDITIONAL VISIT TO THE SITE.

_____ ***SIGNATURE AND DATE OF PERSON REQUESTING
SUBSTANTIAL COMPLETION SITE VISIT BY
ENGINEER.***

_____ **Date of Signature requesting Substantial Completion**

END OF COMMENTS

END OF SECTION

SECTION 27 05 28

GENERAL COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Comply with the provisions of Division 26 Section “Basic Electrical Materials and Methods”.
- B. Provide underground conduit system in accordance with the drawings. Refer to the site plan for conduit routing and sizes. Leave pull cord / rope in all conduits.
- C. Comply with requirements found in the “Systems Coordination Schedule”.
- D. Provide conduit, outlet boxes, sleeves and plywood backboards as indicated on the drawings.

1.3 RELATED WORK

- A. Refer to Division 26 Section “Conductors and Cables”.
- B. Refer to Division 26 Section “Raceways and Boxes”.

PART 2 - PRODUCTS – N/A

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. Leave a nylon pull rope in empty raceway.
- B. Provide 5” square outlet box with single gang plaster ring for each device except where otherwise noted in the drawings.
- C. All outlets not used by the owner’s vendor shall have a blank cover installed.
- D. All cables concealed in walls or above inaccessible ceilings shall be installed in conduit.

- E. Provide adequate (cable installed plus 50% spare) space in “J-Hook” and cabling rings system for routing and bundling of cabling in all corridors not otherwise indicated to receive cable tray.
- F. Support for low voltage wiring not required to be in conduit shall be bundled together in a neat manner using approved nylon tie wraps. Bundled cables shall be supported with “J-Hooks” at a maximum of 5’-0” on centers along all corridors. Identify differing cable types with tags at 25’-0” on center.
- G. J-Hook type shall be at minimum Erico CADDY CAT64. The exact routing to be confirmed in the field and J-Hooks provided as required.
- H. The minimum systems conduit shall be 1 ¼” conduit.

END OF SECTION

SECTION 27 13 00

COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SCOPE

- A. The voice and data systems shall be installed as described in the Systems Coordination Schedule. The contractor shall purchase, install, terminate and certify all Fiber Optic Cabling.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. Section Includes:
 - 1. Pathways.
 - 2. UTP cable.
 - 3. Optical fiber cabling.
 - 4. Cable connecting hardware, patch panels, and cross-connects.
 - 5. Cabling identification products.

1.4 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. RCDD: Registered Communications Distribution Designer.
- G. UTP: Unshielded twisted pair.

1.5 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.6 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.7 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 1. Project will provide electronic files in CAD format, containing the contract document drawing files, for use in the preparing of the shop drawings, by the RCDD.
 - 2. Submit Overall Floor Plans: floor and site plans showing the locations of devices and cable routing paths with cable types and quantity called out.
 - 3. Submit Shop drawings for the entire structured cabling system and grounding and bonding system, identifying such items as PBB, SBB, TBB, rack fills, cabling pathways and pathway fills, ladder and other cable raceways, coordination with other trades, etc.
 - 4. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 5. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 6. Cabling administration drawings and printouts.
 - 7. Wiring diagrams to show typical wiring schematics including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 8. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 - 9. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to side of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.

- d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Qualification Data: For BICSI qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For splices and connectors to include in maintenance manuals.
- G. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.8 QUALITY ASSURANCE

- A. Contractor shall have at least 5 years documented experience installing and testing structured cabling systems of similar type and size. BICSI is an industry trade association.
- B. Contractor shall have all necessary permits, licenses, and inspections required for the performance of data, voice, and fiber optic cable installations.
- C. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff to sign-off on all designs offered, including stamping the design with their current BICSI/RCDD stamp, and supervise the installation, termination and testing of cable systems.
 - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- D. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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.

F. 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.

G. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

H. Grounding: Comply with ANSI-J-STD-607-A.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight.
2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of specified cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes."

2.2 OPTICAL FIBER CABLE

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

1. INDOOR: Corning Cable Systems
2. OUTDOOR: Corning Cable Systems

- B. Description: strand-fiber (qty denoted below), tight buffer, optical fiber cable.

1. OUTDOOR

- a. Service entrance: ALTOS® Loose Tube, Gel-Free, All-Dielectric 012EU4-T4701D20, Outdoor fiber Single Jacket All-Dielectric, Gel-Free, 12 Fibers, Stranded Loose Tube, Single mode G.652.D, Feet jacket marking.

2. Comply with ICEA S-83-596 for mechanical properties.
3. Comply with TIA/EIA-568-B.3 for performance specifications.
4. Comply with TIA/EIA-492AAAA-B for detailed specifications.
5. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG.
 - e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.

- C. Jacket:

1. Jacket Color: Coordinate with MSU ITS.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.3 OPTICAL FIBER CABLE HARDWARE

1. N/A

2.4 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.

- B. Comply with ANSI-J-STD-607-A.

2.5 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces. 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 Division 26 Section "Raceways and Boxes."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- 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.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
 - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

8. 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.
 9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
 10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. Optical Fiber Cable Installation:
1. Comply with TIA/EIA-568-B.3.
 2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
 2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).

- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Division 7 Section "Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Basic Electrical Materials and Methods."
 - 1. Administration Class: 1.
 - 2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 9 Section "Painting and Coating" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 2 level of administration including optional identification requirements of this standard.
- D. Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.
- E. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- G. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) 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 device if color of wire 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 (4.5 m).
 - 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 being extended from a panel or cabinet to a building-mounted device with name and number of particular devices as shown.
 - 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.
- H. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
 - 1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 CABLE TERMINATION AND TEST PLANS

A. General

1. Provide proof of testing technician(s) certification for operation of the specific units of test equipment, which are proposed for use.
2. This Section covers work necessary to furnish communications system testing, including the following:
3. Outside Plant (OSP) Cabling Infrastructure (Campus LAN/WAN extension)
 - a. Back-Bone Cabling Infrastructure
 - b. Horizontal Cabling Systems

B. Inspection Requirements:

1. As part of any performance test, inspect cable, material, and equipment for physical damage, continuity, and proper connection.
2. Verify identification and labeling at required locations for visibility, condition, legibility, and accuracy.

C. Test Report Requirements – Each test report shall include the following sections:

1. Scope of testing
2. List of equipment used in the test with a photocopy of the factory calibration certificate.
3. List of technicians performing the tests identified in the scope of testing.
4. Summary of test results: Hardcopy and electronic copies of the summary forms are to be delivered at conclusion of the project before final payment will be made.
5. Individual test data sheets: The individual test data sheets shall be developed and completed by the contractor. Formatted output from cable scanners is typically acceptable provided they contain all the test parameters including graphs of the information required by this Section.

D. Cable Termination Plans

1. Submit detailed termination plans for both fiber optic and twisted pair cables, which describe how each system component will be installed and terminated.

E. Cable Test Plans

1. Provide testing documentation which includes:
 - a. Dates and times of test
 - b. Personnel performing tests.
 - c. Initial test results
 - d. Description of discrepancies found or failure if any.
 - e. Corrective action if any
 - f. Date and person performing corrections.
 - g. Retest results, if required
 - h. Copy of test equipment calibration certificates
 - i. Intrabuilding (Vertical and Horizontal Subsystem) fiber optic segment post-installation test plan
2. Twisted-Pair Cable Tests: Testing shall be performed using a minimum level IIIe tester.
3. Twisted-Pair Test Plans: Provide separate post-installation test schemes for the following activities:

- a. Backbone Subsystem twisted-pair segment test plan.
 - b. Horizontal Subsystem twisted-pair segment test plan.
4. Fiber-Optic Cable Tests: Testing shall be performed using a level IIIe tester, with approved test-heads approved by the engineer.
5. Fiber-Optic Test Plans: Provide separate post-installation test schemes for the following activities:
 - a. Backbone subsystem fiber-optic segment test plan.
 - b. Horizontal subsystem fiber-optic segment test plan.

F. TESTING AND INSPECTION OF COMMUNICATIONS EQUIPMENT

1. Provide tests specified below, when applicable, and as indicated under individual items of material, equipment, and work specified in this Specification.
2. Furnish all test equipment and instruments required for the tests.
3. Responsible, qualified employees of the contractor in the presence of the Owner or an authorized representative shall perform the cable testing.

G. FINAL TEST AND ADJUST

1. The contractor shall be responsible for post-installation performance testing of all cabling systems specified elsewhere in this Section of the Contract Documents.
 - a. Testing procedures shall permit recording the length of each link, theoretical loss budget, and tested parameters for each pair and fiber.
 - b. Any cable links or fiber strands, which fail to meet performance test criteria, shall be re-terminated, re-connectorized, or replaced by the contractor free of charge.
 - c. Submit final field test documentation in list form.
2. Unshielded Twisted-Pair Cable System Testing
 - a. Permanent Link Test Configuration: Perform metered tests on each multi-pair twisted-pair and/or four-pair UTP cable through the wiring block, patch panel, at each end of the cable section and/or telecommunication outlet (T.O.). The permanent link test shall be undertaken as described in ANSI/TIA 568.2-D.
 - b. Performance Testing:
 - 1) Horizontal Cable System:
 - a) Use a minimum Level IIIe field test instrument capable of the following swept/stepped frequency voltage measurements in accordance with the performance parameters required by ANSI/TIA 568.2-D
 - b) Test each horizontal link to verify/determine, wire map, length, attenuation, skew, and near-end-crosstalk (NEXT) as described in ANSI/TIA 568.2-D.
 - c. Test Reports: Include field test results for each cable including cable link length in accordance with ANSI/TIA 568.2-D.
 - d. The test summary shall include:
 - 1) Cable Identification as it appears on cable schedule.
 - 2) Cable identification as it appears on the individual test reports.
 - 3) Cable identification as it is labeled in accordance with the Specifications.
 - 4) Pass/Fail Status.
 - 5) All test parameters shall appear on each test document including graphics and indicating each test parameter result.

- 6) The individual test data sheet shall include the automated print out produced by the cable scanning equipment.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Visually inspect optical fiber 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/EIA-568-B.1.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 3. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
 1. Provide all applicable portions of the following completed test documentation, in addition to the standard requirements, within 10 days after completion of the tests for each cable channel or link:
 2. Test reports shall be submitted in the following manner:
 - a. To the Owner: One copy on eight and one-half inch by eleven papers providing for quality reproducible printing, and electronic copy in MS Excel format.

- b. Submit test report documentation through CM for review by the Engineer for specification conformance and one copy in electronic format.
3. Twisted-pair field test documentation.

H. Other Contractor Responsibilities

1. Confirmation of Pathway and Cable Manager sizing;
2. Wherever cabling pathways or managers are installed, it is the Contractor's responsibility to confirm pathway or manager sizing to represent no more than 25% fill upon installation according to manufacturer's fill tables.
3. Pathways deemed overfilled upon installation will not be accepted and shall be remedied at Contractor expense.
4. Contractor is responsible for the removal and disposal of all installation and construction debris created in the process of the job.
5. All work areas will be cleaned at the conclusion of the project and no tools or materials shall be left in a manner as to pose a safety hazard.
6. Contractor shall remove all abandoned cable per Article 800 of the National Electrical Code and per TIA and BICSI standards, recycling these materials where possible. Removal of orphaned cable is mandatory. Contractors shall consider this when placing bids.

3.10 DEFINITION OF ACCEPTANCE

- A. System acceptance shall be defined as that point in time when the following requirements have been fulfilled:
 1. All submittals and documentation have been submitted, reviewed, and approved.
 2. The complete system has successfully completed all testing requirements.
- B. All punch list items have been corrected and accepted.

END OF SECTION

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The voice and data systems shall be installed as described in the Systems Coordination Schedule. The contractor shall purchase, install, terminate and certify all data cabling.

1.2 SUMMARY

- A. Refer to the Systems Coordination Schedule and Electrical Legend on the drawings for rough-in and cabling requirements. See cable jacket color requirements this section.
- B. Section Includes:
 - 1. Pathways.
 - 2. UTP cabling.
 - 3. Telecommunications outlet/connectors.
 - 4. Cabling system identification products.
 - 5. Cable management system.
- C. Related Sections:
 - 1. Division 27 Section "General Communications Systems".
 - 2. Division 27 Section " Communications Backbone Cabling".

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

- G. LAN: Local area network.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- I. RCDD: Registered Communications Distribution Designer.
- J. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
 - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors 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 outlet/connector.
 - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. A work area is approximately 100 sq. ft. (9.3 sq. m), and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 - 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.
- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For splices and connectors to include in maintenance manuals.
- G. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. 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.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 - 1. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining

ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways and Boxes." Flexible metal conduit shall not be used.

2.2 BACKBOARDS

- A. Backboards: Comply with requirements in Division 27 Section "General Communications Systems".

2.3 UTP CABLE

- A. Cable shall be Category 6 type equal to Genesis 6000 series.
- B. Cabling shall have colored jackets as described below:
 - 1. Data Outlets – Blue
 - 2. Wireless Access Points – Green
- C. Quantity of Cables: Cables shall be installed at each outlet location as identified on the Electrical Legend (minimum one cable per device location).
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

E. Description: 100-ohm, 4-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6a.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70.

2.1 TERMINATIONS

A. N/A

2.2 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.3 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Basic Electrical Materials and Methods."

2.4 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.

- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways, J-hooks, and cable trays except within consoles, cabinets, desks, and counters. 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 Division 26 Section "Raceways and Boxes."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceways and Boxes" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches (76 mm) above finished floor.

5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: See Specification Section 270528 2.1 for requirements.

3.4 INSTALLATION OF CABLES

- A. Cables shall be routed in raceway to j-hooks and/or cable tray to and terminated in patch panels in the data room on the corresponding floor. Field verify exact location of data room and routing requirements. Provide all coring, sleeves, raceway, etc. as required.
- B. Prior to termination in patch panels cables shall be looped in a figure-8 in order to store 10'-0" of slack as recommended by TIA.
- C. Cables shall be terminated with Mini-Com TX6A or equal UTP Jack Modules at each outlet location.
- D. Cables to WAP (Wireless Access Point) outlet locations and CCTV cameras shall have 15'-0" of slack coiled and wrapped neatly above accessible ceiling at each designated outlet location. Jack Modules shall be enclosed in Panduit CBXQ1IW-A or equal surface mount, plenum rated box.
- E. Cabling to be terminated in existing patch panels where space is available. Otherwise, provide additional patch panels as required to accommodate the new cabling terminations required.
- F. Comply with NECA 1.
- G. General Requirements for Cabling:
 1. Comply with TIA/EIA-568-B.1.
 2. MUTOA shall not be used as a cross-connect point.
 3. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 4. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 6. 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.
 7. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
 8. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
 9. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

H. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

I. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

J. Group connecting hardware for cables into separate logical fields.

K. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).

- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems." See requirements in "Owner Furnished Communications Systems".
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. See requirements in "Grounding and Bonding."
- C. Comply with ANSI-J-STD-607-A.
- D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground – see grounding details on the drawings and coordinate with the engineer prior to installation.
- E. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Basic Electrical Materials and Methods."
 - 1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels as described herein.
- B. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects

with same designation. At completion, cable and asset management software shall reflect as-built conditions.

- C. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- F. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) 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 device if color of wire 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 (4.5 m).
 - 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 being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - 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.
 - 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
 - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

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

B. Perform tests and inspections.

C. Tests and Inspections:

1. Visually inspect UTP and optical fiber cable 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/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test UTP 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.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
5. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- 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

SECTION 27 51 24

INTERCOM SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

- A. The contractor shall be responsible for modifying/expanding the existing Bogen Intercom System providing a complete functional system, including all necessary components, wiring, etc. as described herein and shown on the drawings or as required for a complete and functional system.

1.2 SCOPE OF WORK

- A. The contractor shall furnish and install all equipment, accessories, and materials in accordance with these specifications and drawings to provide a complete and operating school communications system including but not limited to the server and application software, call switches, speakers, controllers, amplifiers, racks, mounts, punch downs, patch cables, wiring and cabling.
- B. The system shall be interconnected to the existing Bogen MCP35A Intercom System. Provide all interconnectivity as required.

1.3 SUBMITTALS

- A. Spec Sheets on all items including cable types
- B. Outline drawing of system control cabinet showing relative position of all major components
- C. Shop drawings, detailing integrated electronic communications network system including, but not limited to, the following:
 - 1. Station wiring arrangement
 - 2. Equipment cabinet detail drawing
- D. Wiring diagrams showing typical connections for all equipment

1.4 QUALITY ASSURANCE

- A. All items of equipment shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.
- B. The contractor shall be an established communications and electronics contractor that maintains a locally run and operated business and has done so for at least 10 years. The contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

- C. The contractor shall show satisfactory evidence, upon request, that he or she maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The contractor shall maintain at his or her facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

1.5 WIRING

- A. Speaker: Ceiling mounted 8” speaker equal to Bogen S86T725PG8UVK compatible with existing system.
- B. Call Button: Wall mounted rocker button equal to CA10A compatible with existing system.

1.6 WIRING

- A. System wiring and equipment installation shall be in accordance with generally-accepted engineering best practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall be tested to be free from grounds and shorts.
- B. All system wiring shall be labeled at both ends of the cable. All labeling shall be based on the room numbers as indicated in the architectural graphics package.
- C. Wiring shall be done per manufacturer's recommendation (Cat 5 or West Penn #357) depending on speaker type. All terminal connections are to be on barrier strips.

1.7 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted speaker and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 REQUIREMENTS

- A. Contract documents are detailed only to the extent required to show design intent. It shall be understood and agreed upon by the Contractor that all work described herein shall be complete in every detail.
- B. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items, may include hardware, rack panels, 66Blocks etc., and other devices that are required for installation.
- C. Labor furnished shall be manufacturer trained and experienced in telecommunication and networked systems.
- D. All equipment unless otherwise specified, shall be new, free from defects, and the best craftsmanship in its class.
- E. Perform initial programming of system and audio level adjustments.
- F. Perform final programming of system and audio level adjustments.

- G. Provide system documentation including equipment manuals and drawings.
- H. Guarantee all equipment and components for their specified period from date of acceptance.
- I. Provide information on system requirements to any Contractor responsible for supplying related materials for this system.
- J. Provide additional components as indicated in drawings.

PART 2 - SYSTEM SPECIFICATION

2.1 MANUFACTURERS

- A. Manufacturers, subject to compliance with requirements specifications, provide the following system:
Existing Bogen Intercom System
- B. This Intercom System for this building is to be interconnected, as required, to the existing campus intercom system as described herein.
- C. The intent is to establish a standard of quality, function, and features. It is the responsibility of the contractor to ensure that the proposed product meets or exceeds every standard set forth in these specifications.
- D. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.
- E. The Intercom System shall be programmed to meet the School District requirements. The Contractor shall meet with the School District maintenance department and obtain programming criteria prior to programming the system. The system shall be tested in the presence of the School District maintenance department staff prior to completion to ensure compliance with the School District criteria and the Contractor shall make required modifications to the system as required to satisfy the School District's requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with the installer present, for compliance with requirements and other conditions affecting the performance of the Bogen Intercom System.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 EQUIPMENT MANUFACTURER'S REPRESENTATIVE

- A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.

3.3 INSTALLATION

- A. The installation, adjustment, testing, and final connection of all conduit, wiring, boxes, cabinets, etc., shall conform to local electrical requirements and shall be sized and installed in accordance with the manufacturer's approved shop drawings.
- B. Low-voltage wiring may be run exposed above ceiling areas where they are easily accessible.
- C. The contractor shall install the new system at the location shown on the plans.
- D. Call Switches shall be wall-mounted:
 - 1. All wiring should be concealed.
 - 2. Verify exact location with architect.
- E. Cabling run above ceiling shall be routed in J-Hooks. No wires shall be laid on top of ceiling tile.

3.4 GROUNDING

- A. The contractor shall provide ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.

END OF SECTION

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ADDRESSABLE FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

- A. Furnish and install a complete Voice Evacuation type Addressable Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. The system shall use closed loop initiating device circuits with individual zone supervision, individual NAC supervision, incoming and standby power supervision. Include a control panel, manual stations, automatic fire detectors, audio/visual devices, annunciators, all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.
- B. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as herein specified and as required for a complete and operable system.
- C. The requirements of the conditions of the Contract, Supplementary Conditions and General Requirements, apply to the work specified in this section.
- D. The complete installation shall conform to the applicable sections of NFPA-72, Local Code Requirements and National Electrical Code with particular attention to Article 760. Devices shall be added as required to comply with all applicable codes. No change orders will be provided for additional devices.
- E. Additionally, the entire installed system and all integrated system operations shall be within the guidelines of the IBC 2023 Code.
- F. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.
- G. The voice evacuation system shall be provided with microphone for making announcements.

1.2 REFERENCES

- A. NFPA 72, the National Fire Alarm Code
- B. NFPA 101 - Life Safety Code®

1.3 REGULATORY REQUIREMENTS

- A. Equipment: All devices, combinations of devices, notification appliances, and equipment, shall be listed for the protective signaling purpose for which they are used and shall be installed in compliance with applicable codes and standards.

- B. Type of System: The control panel shall be Listed for power-limited applications per NEC 760 and for compliance with the National Fire Protection Association Standards NFPA 72; for Local, Auxiliary, Remote Station, and/or Proprietary fire protective signaling systems.
- C. Type of Service: The control panel shall be Listed for the applicable types of service, i.e.; Manual Alarm, Automatic Alarm, Waterflow Alarm and/or Sprinkler Supervisory Service.
- D. Type of Signaling: The control panel shall be Listed for the applicable types of signaling methods used, i.e.; Zone Coded, Non-Coded, March Time and/or Digital Alarm Communicator (DACT) Signaling.

1.4 SYSTEM DESCRIPTION

- A. Fire Alarm System: Provide a complete, supervised, power-limited, fire detection and evacuation system.
 - 1. All equipment herein specified is that of Eaton Safepath or approved equal and depicts the type and quality of the equipment to be furnished. Refer to Submittals, Products/Manufacturers, and Products/Substitutions sections in this specification for further information and qualifications.
- B. System Supervision: The fire protective signaling system shall be an electrically supervised system, which shall monitor the integrity of circuit conductors and power supplies. Performance of fire protective signaling system circuits shall be in accordance with Class B (Style B) operation for Initiating Device Circuits, and Class B (Style Y) operation for initiating service and circuits and operation for Notification Appliance Circuits. Remote annunciator LEDs and associated wiring and remote emergency control wiring shall be supervised; whereas, an open condition in the circuit shall cause a trouble indication at the control panel.
- C. The fire alarm control panel shall allow for loading or editing special instructions and operating sequences as required. The system is to be capable of on-site programming to accommodate facility expansion, building parameter changes, or changes as required by local codes. All software operations are to be stored in a non-volatile, programmable memory resident within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
- D. Initiation circuits shall be individually configurable on-site to provide either alarm/trouble operation, alarm only, trouble only, current limited alarm, no alarm, normally closed device monitoring, a non-latching circuit, or a alarm verification circuit.
- E. The control panel shall provide a minimum of 4 amps of power for notification appliances and auxiliary devices. Provisions shall be available for expanding the standard power to provide an additional 5 amps of power for notification appliances and auxiliary devices.

1.5 OPERATION

- A. Under normal condition, the front panel shall display a "SYSTEM NORMAL" message and the current time and date.

- B. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory, or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steadily for trouble and supervisory conditions.
- C. The following three characteristics relative to an abnormal condition shall be displayed simultaneously in alphanumeric format. Information shall include:
 - 1. Custom location label (40 characters minimum).
 - 2. Type of device (i.e., smoke, pull station, waterflow).
 - 3. Status (i.e., alarm, trouble).
- D. Pressing the appropriate acknowledge button shall acknowledge the alarm or trouble condition. The acknowledge functions may be passcode protected.
- E. After all the points have been acknowledged, the LEDs shall glow steady and the panel audible signal shall be silenced. The total number of alarms, supervisory, and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated. The first 10 fire alarm zones shall be displayed simultaneously in chronological order.
- F. Alarm Silencing
 - 1. Pressing the "Alarm Silence" button shall cause all notification appliances programmed for "On-Until-Silenced" to be deactivated. A separate panel mounted yellow LED shall illuminate to indicate the alarm silenced mode.
- G. System Reset
 - 1. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The display shall step the user through the reset process with simple English language messages.
 - 2. Should an alarm condition continue to exist, the system shall remain in an abnormal state. System control relays shall not reset. The panel audible signal and the Alarm LED shall be on. The display shall indicate the total number of alarms and troubles present in the system along with a prompting to review the points. These points shall not require acknowledgment if they were previously acknowledged.
- H. History Logging.
 - 1. The control panel shall have the ability to store a minimum of fifty (50) events in an alarm log plus a minimum of one hundred (100) events in a separate trouble log. These events shall be stored in a battery protected random access memory (RAM). Real time and date shall accompany all history event recording.
 - 2. History logs shall be capable of being viewed separately or shall be selectable for viewing as a combined history log that displays both alarm and trouble events in chronological order.

I. Walk Test System Testing

1. The system shall be capable of being tested by one person. While in the test mode, the system shall display a trouble condition.
 - a. While in the walk test mode, the activation of an initiating device shall be silently logged as an alarm in the historical log. The panel shall automatically reset after logging the alarm.
 - b. The momentary disconnection of an initiating device or notification appliance shall be silently logged as a trouble condition in the historical log. The panel shall automatically reset itself after logging of the trouble condition.
 - c. Walk Test of ground fault circuit testing shall be verified by operating the Notification Appliances for 4 seconds.

J. Active Status Reminder

1. Should any Alarm, Supervisory, or Trouble condition be present within the system and the audible signal silenced, the local tone alert shall resound every 8 hours (each change of work shift) to act as a reminder that the fire alarm system is not 100% operational.

K. Access Levels

1. There shall be a minimum of four (4) access levels. Passcodes shall consist of up to four (4) digits. Changes to passcodes shall only be made by authorized personnel.
2. Access to a level shall only allow the operator to perform all actions within that level and all actions of lower levels, not higher levels.
3. The following keys/switches shall have access levels associated with them:
 - a. Alarm Acknowledge
 - b. Supervisory Acknowledge
 - c. Trouble Acknowledge
 - d. Alarm Silence
 - e. System Reset

1.6 ALARM SEQUENCE

- A. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch is to be as follows:
 1. All audible alarm notification appliances shall sound with the following characteristics:
 - a. Continuous fire alarm signal until silenced by the alarm silence switch at the control panel.

2. All visible alarm notification appliances:
 - a. Xenon Strobes shall display a continuous synchronized pattern until the system is reset.
 3. Audio / Visual devices shall all operate.
 4. A supervised signal to notify the local fire department or an approved central station is to be activated. The type of "city connection circuit" is to be on-site configurable to provide either a "reverse polarity", "local energy", or dry contact connection. The contractor shall coordinate exact connection required and included in this project.
 5. All air handling units and other HVAC fans serving the affected area shall be shut-down via duct mounted smoke detector, definite purpose contactors and/or area smoke detectors. Refer to mechanical sequences of operation and E300 series sheets for units to be shut-down. Provide appropriate devices to shut-down units and provide wiring to the HVAC units for termination by the mechanical contractor. Coordinate all requirements with mechanical contractor and provide all parts, wiring, and programming as required.
Duct mounted smoke detectors located above ceilings shall be provide with remote ceiling mounted test switch with alarm indicator light.
 6. An alarm is to be displayed on the panel display as defined in the OPERATION section of these specifications. The alarm LED shall flash on the control panel until the alarm has been acknowledged at the control panel. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone after acknowledged shall flash the alarm LED on the control panel and the panel display shall show the new alarm information.
 7. A pulsing alarm tone shall occur within the control panel until acknowledged.
- B. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel shall reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within one minute the system is to resume normal operation. The Alarm Verification is to operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately.
- C. The control panel is to have a dedicated supervisory service LED and a dedicated supervisory service acknowledge switch.
1. The activation of any standpipe or sprinkler valve tamper switch shall activate the system supervisory service audible signal and illuminate the LED at the control panel. Refer to fire protection drawings for exact location of ALL devices. Provide connection as requires.
 2. A waterflow indicator/sprinkler supervisory switch combination IDC type shall be selected allowing a single pair of wires to monitor both conditions. Waterflow monitor shall have priority over sprinkler supervisory monitoring. Refer to fire protection drawings for exact location of ALL devices. Provide connection as requires.

3. Restoring the valve to the normal position shall cause the Supervisory Service LED to extinguish, indicating restoration to normal.

1.6 SEQUENCE OF OPERATIONS

- A. When a fire alarm or trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
 1. The remote-control panels shall display a visual description of the event. Once acknowledged the display shall continuously show the event until the system is reset or another alarm is received. The receipt of another alarm shall cause the display to present a visual description of the new event.
 2. A local audible signal in the remote-control panel shall sound until the system is silenced.
 3. The fluorescent alpha/numeric display shall indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises. The display shall be capable of displaying multiple alarm and/or trouble conditions through the scrolling feature.
 4. Printing and history storage equipment shall log the information associated each new Fire Alarm Control Panel condition, along with time and date of occurrence.
 5. All system output programs assigned via control-by-event logic to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated.
- B. Initiation of ceiling mounted smoke and /or heat detectors shall send a signal to the control panel which shall initiate the following functions:
 1. Initiate a general alarm.
 2. Shut down HVAC fans throughout the building.
 3. Close smoke dampers associated with HVAC fans which shutdown.
 4. Annunciate specific point on the fire alarm annunciator.
 5. Release electrically locked egress doors. This item shall be coordinated with MSU and included, if required.
- D. Initiation of a manual pull station shall send a signal to the control panel, which shall initiate the following functions:
 1. Initiate a general alarm.
 2. Release doors throughout the facility held open by electric door holders.
 3. Manual pull stations shall shut down HVAC fans.
 4. Annunciate specific point on the fire alarm annunciator.
 5. Manual pull stations shall NOT release electrically locked egress doors.

- E. Initiation of a duct-mounted smoke detector shall send a signal to the control panel, which shall initiate the following functions:
 - 1. Initiate a supervisory alarm.
 - 2. Annunciate specific point on the fire alarm annunciator
 - 4. Shut down ONLY the related HVAC fans throughout the building.
 - 5. Close smoke dampers associated with HVAC fans which shutdown.
- F. Initiation of an Automatic Sprinkler System water flow switch shall send a signal to the control panel, which shall initiate the following functions:
 - 1. Initiate a general alarm.
 - 2. Release doors throughout the facility held open by electric door holders.
 - 3. Shut down HVAC fans throughout the building.
 - 4. Close smoke dampers associated with HVAC fans which shutdown.
 - 5. Annunciate specific point on the fire alarm annunciator.
- G. Initiation of the pre-action sprinkler system shall send a signal to the fire alarm control panel, which shall initiate the following functions:
 - 1. Initiate a general alarm.
 - 2. Release doors throughout the facility held open by electric door holders.
 - 3. Shut down HVAC fans throughout the building.
 - 4. Close smoke dampers associated with HVAC fans which shutdown.
 - 5. Annunciate specific point on fire alarm annunciator.
 - 6. Initiate opening of Pre-action valve

1.7 SUPERVISION

- A. There shall be sprinkler supervisory initiation device circuits for connection of all sprinkler valve tamper switches to perform the Supervisory Service Operation. This independent initiation circuit shall be labeled Supervisory Service and shall differentiate between tamper switch activation and wiring faults.
- B. There shall be independently supervised and independently fused NACs for audible notification appliances. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- C. Each independently supervised circuit shall include a discrete panel readout to indicate disarrangement conditions per circuit.
- D. The incoming power to the system shall be supervised so that any power failure must be audibly and visibly indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present.

- E. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visibly indicated at the control panel.
- F. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes. Restoration of a disabled circuit displays the status of the circuit and initiates a count down timer allowing the operator to “Abort the Enable” to prevent unwanted activation of notification appliances, off-premise reporting, and emergency controls.
 - 1. The count down timer shall be programmable from the front panel to be from 0 to 60 minutes.

1.8 POWER REQUIREMENTS

- A. The control panel shall receive 120 VAC power via a dedicated circuit.
- B. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of eight (8) hours. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
- C. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.
- D. All exterior circuits and main power supplies shall have TVSS protection.

1.9 QUALIFICATIONS

- A. Manufacturer: The Manufacturer shall be a nationally recognized company specializing in fire alarm systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 100 miles of this project location.
- B. Installer: The installation organization shall be a company specializing in the installation of fire alarm systems. This organization shall have a minimum of 5 years experience with installation of fire protective signaling systems.

1.10 SUBMITTALS

- A. Submit Manufacturer product data sheets for all proposed devices and equipment.
- B. Provide wiring diagrams, equipment ratings, dimensions, and finishes for all proposed devices and equipment.
- C. If submittals are found not to conform with the performance, type and quality of products as well as all other requirements of these specifications; the Contractor shall be required to resubmit. Approval of the submittals by the Engineer shall, in no case, relieve the Contractor of the responsibility to meet the requirements of this specification.

- D. Provide point-to-point drawings and battery calculations. Submittal will be REJECTED if these items are not provided.
- E. **ALL submittals shall be submitted and approved by the local Fire Marshall BEFORE any equipment can be ordered or installed.** It shall be the contractor's responsibility to provide all corrections noted by the Fire Marshall. These changes must be made at no additional cost to the project.

1.11 PROJECT RECORD (AS-BUILT) DRAWINGS

- A. The Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawings.
- B. Record drawings shall include location of end-of-line device locations.
- C. Upon completion of the work, and final acceptance by the local authority, the Contractor shall submit record drawings to the Engineer.

1.12 OPERATION AND MAINTENANCE DATA

- A. Submit Manufacturer data sheets for all equipment installed.
- B. Include operating, installation, and routine maintenance instructions.
- C. Include Manufacturer letter stating the date of installation on which the system is operational and meets all applicable codes.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site.
- B. Store and protect products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Eaton
- B. Bosch
- C. Honeywell

2.2 SUBSTITUTIONS

- A. Written approval must be obtained from engineer one week prior to bid.

2.3 FIRE ALARM CONTROL PANEL

- A. Provide and install an Eaton Safepath SP40S or equal voice-evacuation Addressable Fire Alarm Control Panel. Construction shall be modular with solid state, microprocessor-based electronics.
- B. Primary Keys & Panel Display
 - 1. The Control Panel's display shall be backlit for enhanced readability. So as to conserve battery standby power, it shall not be lit during an AC power failure unless an alarm condition occurs or there should be keypad activity.
- C. The fire alarm control panel cabinet shall provide the following features:
 - 1. The cabinet shall be equipped with lock.
 - 2. To facilitate installation, the cabinet shall provide:
 - a. Built-In depth gauges for drywall installation.
 - b. Built-In knockouts for mounting holes and wiring conduit entrance.
 - c. A built-in trim band to allow FLUSH mounting into rough cut wall openings.

2.4 INITIATING DEVICES

- A. Pull Station: Siemens Model HMS-D – **Provide a clear plastic cover with an integral alarm to sound when cover is removed.**
- B. Smoke Detector – Ceiling Mounted: Siemens Model S54320-F4-A2 (provide wire cage in Gym area)
- C. Smoke Detector – Duct Mounted: Siemens Model S54319-B23-A1

2.5 FIRE ALARM WIRE AND CABLE

- A. As required by Eaton/Siemens.
- B. **ALL F/A CABLING TO BE INSTALLED IN CONDUIT**

2.6 AUDIO / VISUAL DEVICE:

- A. Siemens Model: S54329-F43-A2 (provide wire cage in Gym area)

2.7 REMOTE ANNUNCIATOR:

- A. Siemens Model: S54400-B16-A1

2.8 CARBON MONOXIDE DETECTORS

- A. Combination Smoke/CO Detector: Siemens S54320-F8-A2.
- B. The CO detector shall be a special color that is clearly different from other fire alarm system smoke detector devices. The preferred color is RED or YELLOW. The new CO detector will be required to annunciate on the control and annunciator panels as CO Detectors when in alarm or trouble.
- C. When in alarm, the fire alarm system must emit a different tone/sound if system is a non-voice evacuation type panel. If the fire alarm control panel is a voice evacuation type device it shall emit a separate message that states a CO message. The exact message shall be coordinated with the university and recorded and added to the system as required.
- D. The CO detector must be able to report a trouble and alarm signal as follows:
 - a. ALARM SIGNAL – CO Alarm Signal will be sent when levels reach the values shown below:
 - 30ppm no less than 30 days
 - 50ppm for 6 to 8 hours
 - 70ppm 60 to 240 minutes
 - 150ppm 10 to 50 minutes
 - 400ppm 4 to 15 minutes
 - b. TROUBLE SIGNAL – CO Trouble Signal will be sent when levels reach 80% of the alarm values – see below:
 - 25ppm no less than 30 days
 - 40ppm 6 to 8 hours
 - 55ppm 60 to 240 minutes
 - 120ppm 10 to 50 minutes
 - 320ppm 4 to 15 minutes

When a CO detector is in alarm, it shall send a general alarm signal (with special tone or message as outlined) to evacuate the building through the fire alarm system. A signal will also be sent to turn natural gas OFF at the main meter for each building. A solenoid type valve will be added to each main gas meter for this purpose. This valve will receive a signal from the fire alarm system when the CO detector goes into alarm ONLY. Coordinate the exact voltage and shut-down method required for this device. The contractor shall be required to provide all hardware, software, power circuits, conduit, wiring and related items as required to make the systems function as described above.

- E. Carbon Monoxide (CO) detectors will be placed at all CO emitting equipment. This includes gas water heaters, boilers, dryers, cooking equipment and related items.
- F. Carbon Monoxide (CO) detectors will be placed in classrooms or assembly spaces served by CO emitting equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate Subcontractors.
- B. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- C. All junction boxes shall be RED in color as manufactured by Cooper, Racor, or equal. Wiring color code shall be maintained throughout the installation.
- D. Conductors must enter each device, terminate on the device, then leave the device. NO "T" taps will be allowed. There shall be NO MORE conductors in the box with the device than the single cable entering and exiting the box. Multiple conductors and splices will NOT be allowed.
- E. Provide and install the system in accordance with the plans and specifications, all applicable codes, and the Manufacturer's recommendations. All wiring shall be installed in accordance with all applicable codes and standards. Upon completion of installation, the Contractor shall so certify, in writing, to the Owner and the General Contractor.
- F. The fire alarm system shall send a signal to the access control system to open ALL doors when the system is in alarm. **The contractor shall coordinate with the door hardware vendor to provide ALL wiring, relays, power supplies and other components required. No change order will be processed to provide fire alarm connectivity to access controlled doors.**

3.2 FIELD QUALITY CONTROL

- A. The completed fire alarm system shall be fully tested in accordance with NFPA-72, by the fire alarm system vendor. This system MUST be completely functional (no troubles or alarms on the system) before the engineer will come to the site for commissioning. Once this is done, the fire alarm system vendor must provide all documentation outlined in NFPA 72 for documenting tests to the engineer. Once this is done, the fire alarm vendor must certify in writing that the fire alarm system is functioning per the contract documents and NFPA 72. The installer will then be required to test the system again in the presence of the Engineer and the Local Fire Marshal.
- B. The Manufacturer shall provide on-site technical installation support.
- C. The electrical and fire alarm system contractors will be required to test all components of the fire alarm system, whether he is responsible for installing them, or not. It should be noted that this will take multiple trips to the site for reviews. Refer to this specification for information associated with testing of this system. Once the contractor has tested and documented ALL fire alarm system devices and associated equipment as working properly with NO TROUBLES or ALARMS showing up on the fire alarm control panel, he may then request a time for the following tests (Fire Alarm and related contractors noted in specs 266100 MUST be present at all of these tests):
 - Testing with ALL contractors that have devices that are monitored by the fire alarm system. This will take multiple trips.

- Testing with the 3rd part fire alarm testing agent, engineer and/or commissioning agent. If all systems do not pass, this could take multiple trips to the site.
- Testing with the fire marshal. If all systems do not pass, this could take multiple trips to the site.

3.3 ON SITE TRAINING

- A. The vendor shall provide a minimum of two (2) hours of on-site training for the facility users. This training shall be video taped by the contractor. Provide a DVD of training.
- B. A list of the persons that attend training shall be included in the O&M manuals.

3.4 CONDUIT

- A. **The entire fire alarm system shall be installed in RED conduit as manufactured by Allied, Wheatland and Republic. Compression fittings are permitted to be standard EMT.**

3.5 CEILING MOUNTED SMOKE DETECTORS

- A. Corridor smoke detectors shall NOT exceed 30 feet on center.
- B. Detectors shall not be located within 3 feet of supply grilles.
- C. Must be installed utilizing bar hangars supported by the ceiling grid.

3.6 MONITORING SERVICE FOR FIRE ALARM SYSTEM

- A. The contractor shall include in his bid the cost of a monitoring service for this facility for one (1) year from the date of acceptance of the building. All cost shall be included in the contractors bid. The school system shall have the right to extend this monitoring service or cancel this service at the end of the one (1) year monitoring service.

3.7 TELEPHONE CABLES REQUIRED FOR MONITORING

- A. The contractor shall coordinate with the school to provide two (2) telephone lines for monitoring of the fire alarm system. Coordinate exact location of lines with the owner and extend lines to the new fire alarm system control panel and connect as required. One line must be a dedicated outside line (can not go through PBX switch). Telephone lines used for monitoring of fire alarm system must be installed in conduit.

3.8 TESTING OF FIRE ALARM SYSTEM

- A. The contractor will be required to test the fire alarm system with a portable, handheld instrument for verification of the correct installation of fire alarm system peripherals and wiring to circuits and modules. The tester shall be used to verify wiring, addressable devices, conventional zones (IDC) and signal circuits (NAC) before the Fire Alarm Control Panel

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(FACP) is commissioned. The tester must be used to help reduce project labor costs by checking installation wiring and device addressing, allowing the contractor to correct any faults before the fire alarm system technician and fire alarm panel arrive on site.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Provide all labor, materials, equipment, and incidentals required to perform all clearing and grubbing of the site as shown on the drawings and as specified herein.
- B. Related sections:
 - 1. Section 31 22 13 – Rough Grading
 - 2. Section 31 23 00 – Excavation and Fill
 - 3. Section 31 25 00 – Erosion and Sedimentation Controls

1.02 QUALITY ASSURANCE

- A. Conform to applicable federal, state, and local codes for removal and disposal of debris.
- B. On-site burning is prohibited.
- C. Burial of debris is prohibited.

1.03 WARRANTY

- A. The Contractor shall guarantee that work performed under this section will not permanently damage trees, shrubs, turf, or plants designated to remain or other adjacent work or facilities. If damage resulting from the Contractor's operations appears during the period up to twelve (12) months after completion of this project, he shall replace the damaged items at no additional expense to the Owner.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 PROTECTION

- A. Identify and protect existing utilities.
- B. Streets, roads, adjacent property, and other works and structures shall be protected throughout the duration of the project. The Contractor shall return to their original condition any facilities damaged by the Contractor's operations.

- C. Trees, shrubs, and grassed areas which are to remain shall be protected by fences, barricades, wrapping, or other methods approved by the Architect. No activity shall be permitted within the tree branch spread of any tree scheduled to remain.

3.02 CLEARING AND GRUBBING

- A. Except as noted below, the Contractor shall remove from the site and satisfactorily dispose of all trees, shrubs, stumps, roots, brush, masonry, rubbish, scrap, debris, pavement, curbs, fences, and miscellaneous other structures as shown, specified, or otherwise required to permit construction of the new work.
- B. Remove roots that are larger than ½" diameter.
- C. Remove debris and rock larger than 0.5 cubic feet.
- D. Trees, stumps, and other cleared and grubbed material may not be disposed on site.
- E. The Contractor shall make a reasonable effort to channel merchantable material into the commercial market to make beneficial use of materials resulting from clearing and grubbing operations.
- F. Burning on site is not permitted.
- G. All burning off the site shall be in complete accordance with the rules and regulations of local authorities having jurisdiction.
- H. Trees and shrubs shall be trimmed when doing so will avoid removal or damage. Trimmed or damaged trees shall be treated and repaired by persons who have experience in this specialty and who are approved by the Architect. Trees and shrubs intended to remain which are removed or are damaged beyond repair shall be replaced by the Contractor at no additional expense to the Owner.
- I. Control dust, dirt, and other particulate air pollution and comply with governing regulations.

END OF SECTION

SECTION 31 22 13

ROUGH GRADING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Execute grading operations in strict accordance with the accompanying Geotechnical Investigation; refer to Section 00 31 32.
- B. Remove topsoil at locations of building slabs, drives, and parking; stockpile for later re-use.
- C. Remove vegetation as required for proposed construction.
- D. Coordinate with utility companies the installation of new underground utilities:
 - 1. Electricity.
 - 2. Water/sewer.
 - 3. Telephone.
 - 4. Gas.
- E. Remove fencing as required.
- F. Take special care to include work shown on the site plans.
- G. Testing of soils.
- H. Sediment control.

1.02 RELATED WORK

- A. Section 03 30 00 – Cast-In-Place Concrete
- B. Section 31 22 19 – Finish Grading
- C. Section 31 23 00 – Excavation and Fill

1.03 PROTECTION

- A. Protect features remaining as a portion of the final landscaping. Avoid damaging trees that do not conflict with new construction.
- B. Take necessary precautions to avoid damaging existing utilities.
- C. Repair any damage caused by the rough grading process.
- D. Grade the site to drain during the construction process. Maintain excavations free of water. Provide and operate pumping equipment to keep excavations free of water.

1.04 COORDINATION

- A. Coordinate rough grading work with underground site utilities. Take special care to protect below-grade utilities. It is the responsibility of the rough grading contractor to confirm underground utility locations prior to initiation of grading work.
- B. Proposed below-grade utilities are to be installed after rough grading is complete.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. It is the responsibility of the Contractor to provide all engineering work associated with lay-out. Written verification of lay-out by a Mississippi-registered engineer or land surveyor is required.
- B. It is the responsibility of the Contractor to provide all engineering work associated with establishing design elevations. Written verification of design elevations by a Mississippi-registered engineer or land surveyor is required.
- C. The Contractor is responsible for work related to sediment control during the construction process and until an established vegetation cover is in place. Sediment control shall be in accordance with the Mississippi Department of Environmental Quality's Storm Water Pollution Control Program. The Contractor is responsible for implementation of a storm water pollution prevention plan which complies with pertinent state regulations. Sediment control shall include at a minimum silt fences, drainage control, and the maintenance of threshed straw over all disturbed areas of the site. Minimum requirements:
 - 1. The Contractor shall limit exposure of disturbed areas to the shortest amount of time practicable and shall divert surface water around disturbed areas of the site whenever possible.
 - 2. The Contractor shall remove sediment from storm water before it leaves the site by appropriate methods.
 - 3. The Contractor shall implement and maintain controls as needed to prevent erosion and sediment from adversely affecting downstream property throughout construction of the project. When work is not being performed in a disturbed area, the Contractor shall install appropriate temporary and/or vegetative and structural practices to ensure that erosion and sediment from the construction site does not flow onto adjoining properties. Other controls shall minimize off-site vehicle tracking of sediments.
 - 4. Controls and management practices used to mitigate adverse impacts from storm water runoff may include, but are not limited to, silt fencing, sediment traps, hay bales, brush, barriers, interceptor dikes, and swales.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Excavated material, graded free of roots, subsoil, debris, and large weeds. Re-use existing topsoil. Stockpile for re-use.
- B. Subsoil: Excavated material, graded free of lumps larger than 6", rocks larger than 3", and debris.
- C. Imported material: Refer to Section 31 23 00.

PART 3 - EXECUTION

3.01 PREPARATION

- A. The Contractor shall lay out the rough grading work from the drawings and shall furnish, set, and maintain all necessary stakes, bench marks, and batter boards for determining clearly all required lines and levels. Verification is required; see 1.05.
- B. The Contractor shall be responsible for his lay-out and shall correct any errors and verify measurements and elevations.
- C. Identify all below-grade utilities. Stake and flag locations. The Contractor is responsible for contacting city, county, and utility officials to ensure that all below-grade utilities are located and flagged.
- D. Identify and flag all above-grade utilities. The Contractor is responsible for contacting city, county, and utility officials to ensure that all above-grade utilities are located and flagged.

3.02 EXCAVATION

- A. Remove all rubbish, concrete, and any remaining topsoil or humus matter prior to construction.
- B. Excavate the site in accordance with the grading plans in an organized manner.
- C. Prior to construction, the in-situ soils shall be scarified to a minimum depth of 8" and compacted to a minimum of 95% of standard proctor.
- D. Prior to filling any area of the site, proof-roll the site under the direction of an approved geotechnical engineer.
- E. Undercut and backfill wet or soft areas of the site with select material as required to achieve compaction to a minimum of 95% of standard proctor. NO UNAUTHORIZED OVER-EXCAVATION SHALL BE PERMITTED.
- F. The receiving subgrade shall be maintained in a moist (above optimum moisture) condition prior to filling.
- G. Relocated and imported materials shall be compacted to 95% of maximum dry density (standard proctor), achieved in maximum loose lifts of 8" at the optimum moisture content established in the laboratory.

3.03 GRADING AND CONTOURING

- A. The Contractor is responsible for all engineering services required to establish grading elevations.
- B. Grade and contour the site in accordance with the grading plans.

3.04 TESTING

- A. A commercial testing laboratory employing a Mississippi-registered geotechnical engineer approved by the Architect and the Owner shall be hired by the Contractor to make all necessary tests; the testing laboratory shall be paid through the testing allowance (refer to Section 01 21 00). One (1) density is required per 2,000 s.f. of lift under parking and drives. One (1) density is required per 2,000 s.f. of lift under buildings. These requirements should be considered minimum requirements and shall be adjusted as necessary by the geotechnical engineer. Test reports shall be signed by the Mississippi-registered engineer.

END OF SECTION

SECTION 31 22 19

FINISH GRADING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Finish-grade the subsoil.
- B. Place, level, and compact the topsoil.
- C. Landscape grading is required in all areas affected by construction.

1.02 RELATED WORK

- A. Section 31 22 13 – Rough Grading
- B. Section 31 23 00 – Excavation and Fill

1.03 PROTECTION

- A. Protect landscaping and trees remaining as final work.
- B. Protect road and curbs.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Topsoil: Install to a minimum depth of 2" over the entire filled or disturbed area of the site.
- B. Provide and install new topsoil to ensure a minimum depth of 2" of topsoil over the entire filled or disturbed area of the site (refer to Section 32 92 19 for topsoil requirements).

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify site conditions and note irregularities affecting the work of this section. Ensure that all below-grade utilities are in place and tested prior to initiating landscape grading work.
- B. Beginning the work of this section means acceptance of existing conditions.

3.02 SUBSOIL PREPARATION

- A. Eliminate uneven areas and low spots. Remove debris, roots, branches, gravel, and dirt clods.
- B. Scarify the subgrade to a depth of 6" where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted the subsoil.

3.03 PLACING TOPSOIL

- A. Place topsoil in areas where topsoil thickness requires additional soil. A minimum of 2" of topsoil is required over all site areas affected by construction.
- B. Use topsoil in a relatively dry state. Place during good weather.
- C. Fine-grade the topsoil, eliminating rough or low areas. Maintain levels, profiles, and contours of the subgrade.
- D. Remove gravel, roots, grass, weeds, debris, and foreign material while spreading.
- E. Break up or remove dirt clods which are larger than 1" in diameter.
- F. Manually spread topsoil around trees and buildings to prevent damage. Take special care not to damage buildings.
- G. Lightly compact the placed topsoil.
- H. Leave the stockpile area and site clean and raked, ready to receive seeding.
- I. Grade the site in the vicinity of buildings and paved areas to ensure drainage away from those buildings and paved areas.

3.04 TOLERANCES

- A. Top of topsoil: Plus or minus ½".

END OF SECTION

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Execute grading operations in strict accordance with the accompanying Geotechnical Investigation; refer to Section 00 31 32.
- B. Site-filling and compaction.
- C. Fill under slabs-on-grade, drives, and parking areas.
- D. Washed gravel under all building slabs-on-grade.

1.02 RELATED WORK

- A. Section 31 22 13 – Rough Grading
- B. Section 31 22 19 – Finish Grading

1.03 COORDINATION

- A. Coordinate fill operations with installation of underground utilities.
- B. Coordinate fill operations with installation of the foundation system.
- C. Coordinate fill operations with installation of the storm drainage system.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. It is the responsibility of the Contractor to provide all engineering work associated with lay-out. Written verification of lay-out by a Mississippi-registered engineer or land surveyor is required.
- B. It is the responsibility of the Contractor to provide all engineering work associated with establishing design elevations. Written verification of design elevations by a Mississippi-registered engineer or land surveyor is required.
- C. The Contractor is responsible for testing and verifying compaction requirements by engaging the services of an approved Mississippi-registered geotechnical engineer selected by the Owner to execute a sufficient number of density tests; the testing agent shall be paid through the testing allowance (refer to Section 01 21 00). Promptly submit copies of all field density tests to the Architect.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

- A. Relocated material shall be free of rubbish, concrete, topsoil, and humus matter.

- B. Imported soils required beneath structures and paving should consist of select lean silty or sandy clay materials conforming to Unified Soil Classifications SC or CL and exhibiting a plasticity index (PI) of 10 to 18.
- C. The receiving subgrade shall be scarified, compacted, proof-rolled, and maintained in a moist (above optimum moisture) condition prior to filling.
- D. Provide 4" of washed gravel under building slabs, size 57 (1" smaller) concrete gravel or approved equal.
- E. A minimum of 5'-0" of select imported material shall be provided beneath and extending 6'-0" beyond all buildings. The top of this fill blanket shall be at the bottom of the 4" gravel fill beneath all slabs.
- F. At all paving surfaces:
 - 1. Minimum of 18" select fill to 95% standard proctor at the optimum moisture content.
 - 2. At light duty asphalt paving: Provide and install 6" of #610 crushed limestone conforming to Mississippi State Highway Department specifications for Class 4 Group B material compacted to minimum of 98% of standard proctor (see ASTM D698).
 - 3. At heavy duty paving: Provide and install 6" of #610 crushed limestone conforming to Mississippi State Highway Department specifications for Class 4 Group B material compacted to minimum of 98% of standard proctor (see ASTM D698).

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that areas to be filled are free of debris, snow, ice, or water and that ground surfaces are not frozen.
- B. Any unsuitable material found after the site has been stripped and proof-rolled shall be removed and replaced by the Contractor.

3.02 PREPARATION

- A. Prior to construction, all rubbish, concrete, and any remaining topsoil or humus matter shall be removed and the in-situ soils scarified to the specified depth and compacted to a minimum of 95% of standard proctor.
- B. Proof-roll the site. Any excessively wet or soft areas shall be undercut and backfilled with select material as directed. No unauthorized over-excavation shall be permitted.
- C. Maintain the receiving subgrade in a moist (above optimum moisture) condition prior to filling.

- D. Prior to construction, the Contractor shall furnish and install drainage ditches to facilitate run-off. Operate pumps and pumping equipment as required.
- E. The Contractor is responsible for lay-out of areas to be filled and all engineering services required to ensure that fill is installed to the required elevations. Written verification is required.
- F. The Contractor is responsible for all engineering testing services as required to verify and confirm that fill under buildings and paving is compacted as specified.

3.03 FILLING

- A. Fill areas to the required contours and elevations. Use unfrozen materials.
- B. Fill systematically, as early as possible, to allow maximum time for natural settlement. Do not fill over porous, wet, or spongy subgrade surfaces.
- C. Compaction shall be achieved in maximum loose lifts of 8".
- D. Make changes in grade gradually. Blend slopes into level areas.
- E. All fill under buildings, drives, and parking areas shall be compacted to 95% of maximum dry density (standard proctor), achieved in maximum loose lifts of 8" at a moisture content comparable to the optimum moisture content established in the laboratory.
- F. All fill placed outside building and parking areas shall be compacted to 90% of maximum dry density (standard proctor).
- G. Clay gravel or crushed limestone under concrete/asphalt/gravel or crushed stone paving shall be compacted to a minimum of 98% of standard proctor (see ASTM D698).
- H. The Contractor is responsible for testing and verifying compaction requirements by engaging the services of an approved Mississippi-registered geotechnical engineer selected by the Owner to execute a sufficient number of density tests; the testing agent shall be paid through the testing allowance (refer to Section 01 21 00). Promptly submit copies of all field density tests to the Architect.

3.04 TESTING

- A. A commercial testing laboratory employing a Mississippi-registered geotechnical engineer and approved by the Architect and the Owner shall be by the Contractor from the testing allowance (refer to Section 01 21 00) to make all necessary tests. These requirements should be considered minimum requirements and shall be adjusted as necessary by the geotechnical engineer. Test reports shall be signed by the Mississippi-registered engineer.
- B. Field moisture-density tests should be performed utilizing a nuclear device in accordance with ASTM D2922 at a frequency of:
 - 1. One (1) test per 2,000 s.f. of prepared subgrade beneath structures or paving.

2. One (1) test per 2,000 s.f. per 8" loose lift of relocated or imported fill beneath structures or paving [minimum three (3) tests per lift beneath structures].
3. One (1) test per 2,000 s.f. of prepared sub-base or base beneath pavement.

END OF SECTION

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work included:
 - 1. Provide and install measures to prevent and control erosion and sedimentation during construction.
- B. Related sections:
 - 1. Section 31 22 13 – Rough Grading
 - 2. Section 31 22 19 – Finish Grading
 - 3. Section 31 23 00 – Excavation and Fill
 - 4. Section 32 92 20 – Seeding

1.02 QUALITY ASSURANCE

- A. Establish sediment control barriers prior to the beginning of clearing and maintain during the entire period of construction.
- B. Clean out and dispose of any sediment that inhibits the proper functioning of erosion control measures or when the storage capacity of any sediment facility is reduced by one-half.
- C. The sedimentation control measures specified herein are minimum requirements. It is the Contractor's responsibility to take necessary measures to prevent and control erosion and sedimentation. Additional requirements to meet local, state, or federal erosion and sediment control ordinances shall be designed, installed, and maintained by the Contractor.

PART 2 - PRODUCTS

2.01 SEDIMENT CONTROL

- A. Straw bales: Wire-bound or string-tied bales.
- B. Silt fence:
 - 1. Silt Stop by American Excelsior Company of Arlington, Texas.
 - 2. Envirofence by Mirafi of Charlotte, North Carolina.
 - 3. Exxon GTF 100S by Exxon of Atlanta, Georgia.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Provide and install grass, silt fences, and straw bale barriers as required to prevent and control the loss of soil from the construction site and to prevent erosion of soil into local receiving waters or onto adjacent property.
- B. Straw bale barriers:
 - 1. Provide and install straw bales around each storm drain, catch basin, area drain, or curb inlet to prevent sediment from entering underground storm drains. Place each bale in a 4" trench and backfill to anchor and prevent undermining.
 - 2. Anchor each bale with two (2) #3 x 36" reinforcing bars.
 - 3. Fill gaps between bales with loose straw to prevent sediment from escaping between the bales.
- C. Silt fence:
 - 1. Install silt fence in ditches and swales as necessary to prevent sedimentation.
 - 2. Install silt fence in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 31 31 16
TERMITE CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Treatment below all slabs for subterranean insects.
- B. Treatment of crawl spaces and foundations systems for subterranean insects.
- C. Treatment of horizontal barriers at perimeter of structure.

1.02 REGULATORY REFERENCES

- A. EPA – Federal Insecticide, Fungicide and Rodenticide Act.
- B. Regulations Governing Pest Control Operators, Mississippi Department of Agriculture and Commerce, Bureau of Plant Industry.

1.03 QUALITY ASSURANCE

- A. Applicator: Company specializing in soil treatment for termite control with three (3) years of documented experience.
- B. Materials: Provide certification that toxicants comply with EPA requirements.
- C. Material packaging: Manufacturer's labels and seals identifying content.

1.04 REGULATORY REQUIREMENTS

- A. Comply with State of Mississippi requirements for application licensing and authority to use toxicant chemicals.
- B. Specific license/permit category requirements: Control of Termites and Other Structural Pests, Control of Pests in Homes, Businesses and Industries.
- C. Comply with the requirements of the EPA.

1.05 PRODUCT DATA

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit product data.
- C. Indicate toxicants to be used, composition by percentage, dilution schedule, and intended application rate.
- D. Submit the manufacturer's installation instructions.
- E. Submit warranty document for approval.

- F. Submit a copy of the applicator's license.

1.06 BOND AND INSURANCE REQUIREMENTS

- A. Minimum surety bond sum:

1. \$5,000.00.
2. As required by the regulations listed in 1.02, if greater.

- B. Minimum insurance:

1. \$100,000.00 per occurrence or aggregate of \$200,000.00.
2. As required by the regulations listed in 1.02, if greater.

1.07 WARRANTY

- A. Provide five-year warranty for material and installation.
- B. Warranty: Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites, and repairs to building or building contents so caused.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Chemicals used must be those acceptable to the Division of Forest Insect Research, Forest Service, USDA, or proprietary products registered with the Pesticide Regulation Section, Agricultural Research Service, USDA, under the Federal Insecticide, Fungicide and Rodenticide Act, for use as a termite toxicant for which prolonged effectiveness may be anticipated. The following chemicals and concentration in water solution shall be used:
 1. Termidor by BASF.
- B. Proprietary material may be used:
 1. If they meet a U.S. Forest Service five-year field test;
 2. If they contain one or more of the above named chemicals in the concentration given;
 3. If proof is provided that no toxic effects to humans or beneficial plant and animal life will result from their use.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Verify that the substrate is in friable condition with moisture content low enough to permit absorption of the toxicant solution.

- B. Do not begin work until all preparatory work for slab placement has been completed.

3.02 APPLICATION

- A. Location:

1. Apply soil treatment to areas beneath concrete slabs.
2. Additional termiticide is required if fill is gravel or other coarse aggregate.
3. Additional termiticide is required at bath traps and other openings in the slab.

- B. Rates of application:

1. Apply in strict accordance with the chemical manufacturer's written instructions.
2. Apply at concentrations or volume as specified on the label of the approved pesticide product.
3. Strictly comply with EPA requirements and regulations.

- C. Application technique:

1. Treatment shall not be made when the substrate is wet or immediately after heavy rains; avoid surface flow of toxicant from the application area.
2. Unless the substrate is promptly covered with fill and vapor barrier, precautions shall be taken to prevent disturbance of the treatment and human or animal contact with treatment and treated soil.

- D. All pretreats shall be made in strict accordance with label directions as specified on the label of the pesticide being applied.

- E. All perimeter treatments must be performed within one (1) year of treatment of the horizontal barrier. Perimeter treatments include the vertical barrier around the perimeter of the structure.

- F. Pretreatments shall include all structures built adjacent to the foundation, such as porches and patios.

- G. Reapply treatment if rainfall follows initial treatment or if slab is not poured within twenty-four (24) hours of treatment.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Asphaltic concrete pavement (Alternate No. 1).

1.02 RELATED WORK

- A. Section 09 91 00 – Painting
- B. Section 31 22 13 – Rough Grading
- C. Section 31 22 19 – Finish Grading
- D. Section 31 23 00 – Excavation and Fill

1.03 QUALITY ASSURANCE

- A. General requirements of gravel base course: Meet or exceed the applicable requirements of and place in accordance with the Mississippi Standard Specifications for Road and Bridge Construction, Mississippi State Highway Department, Section 304, Class 4, Group A, or Section 315 Base.
- B. General requirements of asphaltic concrete pavement: Meet or exceed the applicable requirements of and place in accordance with the Mississippi State Highway Department Standard Specification for Road and Bridge Construction, 1990 Edition, Section 403-C (Type SC-1).
- C. Submittals:
 - 1. Refer to Section 01 33 00 for additional information related to submittal format.
 - 2. Prior to construction, submit proposed job mix formulas for asphalt base course and asphalt surface course to the laboratory along with a 30# ± sample of each aggregate to be utilized.

PART 2 - PRODUCTS

2.01 AGGREGATE

- A. Meet the requirements of the Mississippi State Highway Standard Specifications, Section 304, Class 4, Group A. Verify materials used in design mix.

2.02 TACK COAT

- A. Emulsified asphalt (SS-1): ASTM D977-80

2.03 ASPHALTIC CONCRETE BASE COURSE

- A. Mix components and composition to comply with applicable MDOT criteria for Type BB-1 material. 2" thickness standard duty. 4" thickness heavy duty.

2.04 ASPHALTIC CONCRETE SURFACE COURSE

- A. Mix components and composition to comply with applicable MDOT criteria for Type SC-1 material. 1½" thickness required at light duty, 2" thickness required at heavy duty.

2.05 CLAY GRAVEL

- A. Refer to Section 31 23 00 – Excavation and Fill.

2.06 STRIPING

- A. Refer to Section 09 91 00 – Painting.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Inspect the site area scheduled for paving after rough grading work has been completed and field density test results confirm compaction of 95% of standard proctor.
- B. Do not initiate the work of this section until the substrate is acceptable. Initiation of the work of this section is evidence that the paving contractor approves and accepts the substrate and existing conditions.

3.02 TACK COAT PLACEMENT

- A. Place the tack coat on a slightly moist, clean base free from loose or foreign material when the atmospheric temperature is above 50° F.
- B. Apply 0.05 to 0.08 gallon per square yard (depending on surface texture) of an emulsified asphalt, Grade SS-1, and water mixture (approximately 25% water by volume, not to exceed 50%) with a pressure distributor at a temperature between 50° F and 120° F.

3.03 ASPHALTIC CONCRETE BASE AND SURFACE COURSE

- A. Install when the underlying course is dry and the weather is not rainy. Do not install the surface course when the atmospheric temperature is below 40° F unless directed otherwise by the Architect.
- B. Heat the asphalt cement in a manner that ensures even heating of the entire mass under efficient and positive control at all times, at the plant, in the kettles or tanks at a temperature between 275° F and 325° F.
- C. Do not start placing until the prime or tack coat has set. Paint the contact surfaces of all structures with hot bituminous material as used in the mixture. Spread the mixture by mechanical spreaders; spread the mixture by hand only in inaccessible locations. The temperature of the mixture when spread will be between 225° F and 275° F.
- D. Compaction:

1. After the mixture is spread and as soon as it will bear the roller without undue displacement or hair cracking, roll the mixture with a three-wheel roller weighing not less than 10 tons or a tandem type steel roller of equal wheel concentrated area.
 2. Equip the roller wheel with scraping and sprinkling devices and keep it properly moistened without excess of oil or water.
 3. Start rolling longitudinally at the sides and proceed toward the center. Each trip of the roller will overlap the previous trip by at least 1'. Alternate trips of the roller will be of slightly different lengths.
 4. Continue rolling until all creases have been removed and a density is attained equal to or above 98% of the density obtained in a laboratory specimen of the same mixture when subjected to seventy-five (75) blows per side in the Marshall Mold.
- E. Joints: When new mixture is placed against previously placed mixture, cut the joint back to a clean, vertical surface and apply a tack coat to the vertical edge prior to asphalt placement.
- F. Testing:
1. Verify mix characteristics through one (1) extraction and stability test performed for each day's production or a portion thereof for each type of mix placed.
 2. The Contractor shall verify the in-place density and thickness of completed pavement by extracting a minimum of three (3) cores for submittal to the laboratory. Core locations are to be selected by the testing laboratory and cavities patched by the Contractor.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Provide and install chain link fencing at HVAC unit enclosures.

1.02 SUBMITTALS

- A. Refer to Section 01 33 00 for additional information related to submittal format.
- B. Submit the manufacturer's technical data and installation instructions for metal fencing and gates.

1.03 DIMENSIONS

- A. Dimensions for pipe are outside dimensions.
- B. At mechanical unit enclosures, verify the actual sizes of mechanical units and slabs prior to fabrication.

PART 2 - PRODUCTS

2.01 CHAIN LINK FENCE MATERIALS

- A. Wire gauge and mesh: 11 gauge, 2" mesh.
- B. Intermediate posts: 1½" o.d. steel pipe, 10'-0" o.c. max. Schedule 20 at 1.74 lbs./ft.
- C. Rails: 1⅜" o.d. steel pipe in the longest possible lengths with couplings. Schedule 20 at 1.43 lbs./ft.
- D. Post tops: Weathertight closure caps.
 - 1. Permit passage of top rail.
 - 2. Provide means for attaching top rails at each condition encountered.
- E. Accessories: Stretcher bars, 12½ gauge tension wire, wire ties at 12" o.c., and other items as required to provide a complete and finished system.
- F. Fence finish: All components shall be pre-galvanized unless otherwise noted.
- G. Fence height: 6'-0". Hold the bottom of the fence 6" above the finished grade to facilitate maintenance.
- H. Concrete footings: As recommended by the fence supplier.
- I. At mechanical enclosures, provide and install strap anchors and bolts at 30" o.c. at concrete slabs [required at all three (3) sides of enclosure].

2.02 GATES

- A. Metal and finish are to match the framework. Provide horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Space so that frame members are not more than 8' apart. 2" o.d. frame, Schedule 20 pipe.
- B. Assemble gate frames by welding or with special fittings and rivets for rigid connections. Use the same fabric as for the fence unless otherwise indicated. Install fabric with stretcher bars at vertical edges. Attach stretchers to the gate frame at not more than 15" o.c. Attach hardware to provide security against removal or breakage. Install diagonal cross-bracing consisting of $\frac{3}{8}$ " diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist. Maximum 1" clearance at the top of the curb.
- C. Gate hardware: Furnish the following hardware and accessories for each gate:
 - 1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 105-degree gate opening. Provide 1½ pair of hinges for each leaf over 6' nominal height.
 - 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of the latch.

2.03 MISCELLANEOUS

- A. Accessories: Stretcher bars, 12½ gauge tension wire, wire ties at 12" o.c., and other items as required to provide a complete and finished system.
- B. Fence finish: All components shall be pre-galvanized unless otherwise noted.
- C. Padlock hasps: Provide and install padlock hasps at all gates. Padlocks by Owner.

PART 3 - EXECUTION

3.01 INSTALLATION OF CHAIN LINK FENCES

- A. Confirm locations and avoid underground utilities.
- B. Confirm exact size of slabs and mechanical units prior to initiating the work.
- C. Make adjustment in sizes as required.
- D. Comply with the recommended procedures and instructions of the fencing manufacturer. Provide a secure, aligned installation.

END OF SECTION

SECTION 32 92 20

SEEDING

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Preparation of soil for seeding disturbed areas. Seeding and straw mulching are required at all areas of the site affected by construction activity.
- B. Seeding and fertilizing as required to control erosion.
- C. Seeding and fertilizing to establish permanent common Bermuda grassing at all areas of the site affected by construction activity which are not paved, built on, or sodded.

1.02 RELATED WORK

- A. Section 31 22 19 – Finish Grading

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed in its original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages are not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and the name of the manufacturer.

1.04 EXISTING CONDITIONS

- A. Beginning the work of this section means acceptance of the existing conditions.

PART 2 - PRODUCTS

2.01 GROWING MEDIA

- A. Existing and/or new topsoil: Natural, fertile agricultural soil capable of sustaining vigorous plant growth, not in a frozen or muddy condition, containing not less than 6% organic matter, and corrected to a pH value of 5.9 to 7.0. Free from subsoil slag, clay, stones, lumps, live plants, roots, sticks, crabgrass, coughgrass, noxious weeds, and foreign matter.
- B. Fertilizer: Grade 13-13-13 commercial type with 50% of the elements derived from organic sources.
- C. Threshed straw: Free of Johnson grass, weed seed, and noxious materials. Rate of spread: 40 bales per acre. Threshed straw is required over all site areas where seeding is required. Minimum 1" thick, blown or spread and then watered down.
- D. Sand: Hard, granular natural beach sand, washed and free of impurities and chemical or organic matter.

2.02 SEED

- A. The seed shall be of the best grade and of known vitality, purity, and germination and shall be delivered in bags as required by law, each bag being tagged showing the percent of germination and purity of the seed, as well as the percent of noxious weeds and inert litter. All seed shall be free of wild onion, Canada Thistle, and Johnson Grass. One (1) pound of seed shall not contain more than three hundred (300) noxious seeds. No seed more than one (1) year old will be accepted. Seeding shall be done with grasses which will germinate in the season planted as shown in the following table (unless specified otherwise):

May 2 - August 15	Bermuda Grass
August 16 - September 15	Mix Bermuda/Rye
September 16 - February 15	Rye
February 16 - May 1	Mix Bermuda/Rye

Bermuda grass seed shall be hulled; mixtures shall be 1:1 ratio by weight.

Note: Common Bermuda grass is considered permanent grass; rye grass is considered winter grass only. Permanent grass cover is required at the site.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect existing underground improvements from damage.
- B. Remove foreign materials, plants, roots, stones, and debris from the site. Do not bury foreign material.
- C. Remove contaminated subsoil.
- D. Cultivate all areas affected by construction to a depth of 6". Repeat cultivation in areas where equipment has compacted the subgrade.
- E. Execute grassing work as early as possible in the construction process to avoid erosion and to ensure that a good stand of grass is present upon substantial completion of the work.

3.02 SPREADING TOPSOIL

- A. Spread topsoil to a minimum depth of 2" over the area to be seeded. Place during dry weather and on a dry, unfrozen subgrade.
- B. Cultivate topsoil with mechanical tiller. Cultivate inaccessible areas by hand. Rake until the surface is smooth. Break up dirt clods that are larger than 1" in diameter.
- C. Remove from the site foreign materials collected during cultivation.

- D. Grade to eliminate rough spots and low areas where ponding may occur. Maintain a smooth, uniform grade.
- E. Assure positive drainage away from buildings. Assure positive drainage towards drainage ditches and catch basins.

3.03 FERTILIZER

- A. Apply fertilizer at a rate of 10 lbs. per 1,000 s.f. (4.5 kg per 100 sq. m).
- B. Do not apply grass seed and fertilizer at the same time in the same machine.
- C. Lightly water to aid the breakdown of fertilizer and to provide a moist soil for seed.

3.04 SEEDING

- A. Apply seed at a rate of 6 lbs. per 1,000 s.f. evenly in two (3) intersecting directions. Rake in lightly.
- B. Do not sow immediately following rain, when the ground is too dry, or during a windy period.
- C. Roll the seeded area with a roller not exceeding 112 lbs. Apply materials to control erosion at banks scheduled to be seeded.
- D. Apply water with a fine spray immediately after each area has been sown.
- E. Mulch all grassed areas with straw.

3.05 MAINTENANCE PERIOD

- A. Maintenance period: The Contractor shall maintain the site until the project is accepted by the Architect and the Owner as substantially complete.

3.06 MAINTENANCE

- A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion. Furnish and install straw or hay to control erosion.
- B. Water to ensure uniform seed germination and to keep the surface of the soil damp.
- C. Apply water slowly so that the surface of the soil will not puddle and crust.
- D. Cut grass the first time when it reaches height of 2½" and maintain to a minimum height of 2". Do not cut more than ⅓ of the blade at any one mowing.
- E. After the first mowing, water grass sufficiently to moisten the soil from 3" to 5".
- F. Apply weed killer (when weeds start developing) during calm weather when the air temperature is above 50° F.

- G. Replant damaged grass areas showing root growth failure, deterioration, bare or thin spots, or eroded areas.

3.07 ACCEPTANCE

- A. Seeded areas will be accepted at the end of the maintenance period when seeded areas are properly established and otherwise acceptable.

3.08 REPAIRING

- A. Unaccepted areas requiring reseeding shall be so designated by the Architect. Reseeding shall be in compliance with the specifications herein and in accordance with the planting schedule.
- B. When grassed areas have become eroded or otherwise damaged during the period of this Contract, the affected areas shall be repaired to re-establish the surface and the condition of the soil as provided for in these specifications. Such areas shall be reseeded as specified. Placing and reshaping of all earthwork shall be in accordance with the direction of the Architect.
- C. No additional payment will be made for refertilizing, reseeding, or repairing eroded areas.

END OF SECTION

APPENDIX “A”
SPECIAL PROVISIONS

PART 1 - GENERAL

1.01 SUMMARY

- A. Following this page are special provisions stipulated by the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program.
- B. The Contractor shall abide by these provisions.
- C. These provisions will be attached to the Owner-Contractor Agreement as an exhibit.

END OF SECTION

GENERAL TERMS AND SPECIAL CONDITIONS

Award is hereby made in the amount and for the period shown above of a grant under The Housing and Community Development Act of 1981 - Public Law 97-35), and as amended by the Housing and Urban-Rural Recovery Act of 1983, to Applicant Name "Subgrantee", in accordance with the plan set forth in the application of the above mentioned Subgrantee and subject to any attached revisions or special conditions.

This contract is subject to all applicable rules, regulations, conditions, and assurances as prescribed by the Mississippi Development Authority's (MDA) Community Development's Block Grant Program Final Statement, as well as the U.S. Department of Housing and Urban Development's Community Development Block Grants: State's Program Final Rule (24CFR Part 570), and to each and every Federal and State Statute and guideline affecting the application for, receipt of, and expenditure of Community Development Block Grant funds. It is also subject to such further rules, regulations, and policies as may be reasonably prescribed by the State or Federal Government consistent with the purposes and authorization of P.L. 97-35 and P.L. 98-8.

1. Application of the Mississippi Employment Protection Act of 2008.

All grantees, recipients, contractors and companies known here after as "Contractor (Company)" entering into contracts with the Mississippi Development Authority represents and warrants that it will ensure compliance with the Mississippi Employment Protection Act (Senate Bill 2988 of the 2008 Regular Session of the Mississippi Legislature) and will register and participate in the status verification system of all newly hired employees. The term "employee" as used herein means any person that is hired to perform work within the State of Mississippi. As used herein, "status verification system" means the Illegal Immigration Reform and Immigration Responsibility Act of 1996 that is operated by the United States Department of Homeland Security, also known as the E-Verify program, or any other successor electronic verification system replacing the E-Verify Program.

Contractor (Company) agrees to maintain such compliance and, upon request of the State, to provide copy of each such verification to the State. Contractor (Company) further represents and warrants that any person assigned to perform services hereunder meet the employment eligibility requirements of all immigration laws of the State of Mississippi. Contractor (Company) understands and agrees that any breach of these warranties may subject Contractor (Company) to the following: (a) termination of this Agreement and ineligibility for any state or public contract in Mississippi for up to three (3) years , with notice of such cancellation/termination being made public, or (b) the loss of any license, permit, certification or other document granted to Contractor (Company) by an agency, department or governmental entity for the right to do business in Mississippi for up to one (1) year, or (c) both. In the event of such termination/cancellation, Contractor (Company) would also be liable for any additional costs incurred by the State due to contract

cancellation or loss of license or permit.

This contract is also made subject to any and all conditions, special conditions, and assurances attached hereto and made a part hereof at the time of the award of these funds. The application submitted for these funds is incorporated by reference herein and made a part hereof, including any changes, modifications, deletions, or amendments contained therein. Any unauthorized change or amendment by the Subgrantee to the provisions of this contract shall be considered invalid, and MDA reserves the right not to reimburse the Subgrantee for any expenses or costs associated with such an unauthorized change or amendment.

MDA reserves the right to withhold grant funds or to terminate this contract for cause, if the Subgrantee fails to fulfill in a timely and proper manner the obligations under this contract or if the Subgrantee should violate any of the covenants, agreements, conditions, special conditions, or assurances of this contract, by giving written notice to the Subgrantee of the suspension or termination, specifying the effective date thereof, at least five (5) days before the effective date thereof.

The Subgrantee hereby agrees that the project and activities for which these grant funds are awarded shall constitute a fully completed and operative project upon conclusion, and the Subgrantee further agrees that in the event the costs of the project exceed the funds awarded under this contract, then it is understood that the state will not provide additional funding. The Subgrantee agrees to and understands that the CDBG award is limited to the amount under this agreement. Any cost overruns will be the sole responsibility of the Subgrantee. This grant shall become effective on the beginning date of the grant period stated in section 5 of page 1 provided that this contract shall have been fully completed, executed by the Subgrantee, and received in the office of MDA.

Subgrantees are prohibited from contracting with or making subawards to parties that are suspended or debarred or whose principals are suspended or debarred by MDA, any federal agency or other Mississippi state agency. Suspension or debarment may apply to new and/or ongoing transactions. An official copy of the MDA's Debarment and Suspension Policy and all applicable regulations and guidelines can be obtained from the MDA, Community Incentives Division by calling (601) 359-3179.

2. Debarment and Suspension

The Mississippi Development Authority (MDA), Community Incentives Division (CID) must ensure that Sub-recipients (Local Units of Government and Non-Profit Agencies) of federal assistance are not debarred or suspended, or otherwise excluded from or ineligible from participation in Federal Programs under Executive Order 12549 and per 2 CFR Part 200. MDNCID has performed the required due diligence by verifying the SAM.GOV database to ensure at pre-award that all sub-recipients have met this certification. In the event that a Sub-recipient is found to be suspended, debarred, ineligible, or voluntarily excluded from federal grant program participation at any time during the contract period,

MDNCID may pursue available remedies, including suspension and/or debarment or termination of the existing grant agreement.

3. Special Conditions That Require Written Clearance

A. Mississippi State Department of Health Approval

If applicable, prior to the release of any CDBG funds for water improvement construction, the Subgrantee shall provide written documentation that the plans and specifications have been approved by the Mississippi State Department of Health.

B. Department of Environmental Quality Approval

If applicable, prior to the release of any CDBG funds for wastewater or solid waste improvement construction, the Subgrantee shall provide written documentation that the plans and specifications have been approved by the Mississippi Department of Environmental Quality, Office of Pollution Control.

C. Mississippi Public Service Commission Approval

If applicable, prior to the release of CDBG funds for water, sewer, and gas system construction, the Subgrantee shall provide evidence that the Mississippi Public Service Commission has issued a "Certificate of Public Convenience and Necessity" for improvements in an uncertificated and/or unserved area, and/or the transfer of ownership of a system.

4. Building Standards

If applicable, all building construction shall comply with the applicable codes and standards approved by the Southern Building Code and Congress International, Inc., or to locally adopted codes, whichever are more stringent.

5. State Aid Standards

If applicable, streets or access roads shall be designed and constructed at least to minimum State Aid standards or to local subdivision standards, whichever are more stringent.

6. LMI Hook-Ups

Low- and moderate-income persons must actually be hooked up to the system in order to be counted as beneficiaries on water, sewer, or gas projects. CDBG funds cannot be used to install nor connect service lines if the property is owned by a person who is not of low- or moderate-income, even if the renter is of low- or moderate-income. The cost of connecting LMI property owners to the service lines can be paid from CDBG or other funds, but the connection to the system must be at no cost to the LMI beneficiaries.

7. Generators and Auxiliary Power Sources

CDBG funds may not be used for the purchase of generators or auxiliary power sources in water or sewer improvement projects. The only exception is when the generator is built-in on the wastewater pump stations.

8. Nonperformance Standard

If at the end of 12 months from the start of the contract period and construction has not begun, the Mississippi Development Authority, may, at its option, terminate this contract and recapture funds allocated. No contract extensions will be granted unless the Subgrantee can document circumstances beyond its control that prevented construction.

9. Fire Safety Codes

If applicable, the Subgrantee must comply with local fire safety codes.

10. Program Income

If any program income is generated as result from CDBG funds, the subgrantee shall return these funds to the Mississippi Development Authority. However, 570.489 (e)(2)(v)..."proceeds received from the sale of real property acquired or improved in whole or part with CDBG funds will not be considered program income if the proceeds are received more than 5 years after expiration of the grant agreement and are, therefore, exempt from being tracked."

11. Application

The application and all supporting documentation are incorporated by reference herein and made a part hereof, including any changes, modifications, deletions, or amendments contained therein.

12. Paymode

Payments by state agencies using the State's accounting system shall be made and remittance information provided electronically as directed by the state. These payments shall be deposited into the bank account of Contractor's choice. The State may, at its sole discretion, require contractor to electronically submit invoices and supporting documentation at any time during the term of this Agreement. Contractor understands and agrees that the State is exempt from the payment of taxes. All payments shall be in United States currency.

FINANCIAL MANAGEMENT, REPORTS AND RECORD KEEPING

The local government shall comply with all MDA, State of Mississippi Office of Management and Budget (OMB) and CDBG rules, regulations, circulars, policies, and procedures on financial management for all contract expenditures. The local unit of government shall ensure that its financial management systems provide the necessary internal controls, accounting records and reporting systems to meet generally accepted accounting standards and comply with the applicable OMB uniform cost principles for the type of entity receiving the funds. MDA reserves the right to inspect the local unit of government's financial management systems and to impose additional accounting requirements to ensure that accounting requirements are being met.

1. Access to Records and Facilities

The State of Mississippi, Federal monitors and auditors and any persons duly authorized by the Federal government, the State of Mississippi and MDA shall have full access to and the right to examine and copy any or all books, records, documents and other materials regardless of form or type which are pertinent to contract performance or which reflect direct and indirect costs related to this contract. Access right shall continue during the record retention period after the contract's ending date. This access right shall extend to all business hours and places where any contract activity is conducted. MDA shall include these access requirements in all subcontracts.

2. Audits and Monitoring

The local unit of government shall adhere to applicable Office of Management and Budget (OMB) Circulars and other applicable Federal, State of Mississippi and MDA regulations, policies and procedures governing audits and monitoring. Recipients of Federal awards, as defined by OMB Circular 2 CFR Part 200 (formerly known as Circular A-133) and 29 CFR 99, shall maintain records that identify all Federal funds received and expended. The local unit of government shall comply with any applicable future amendments to OMB Circular 2 CFR Part 200 (formerly known as A-133) and any successor or replacement Circular or regulation.

The local unit of government shall be audited annually in accordance with Circular 2 CFR Part 200 or, if 2 CFR Part 200 is inapplicable, shall arrange for an annual audit of contract funds received from MDA. All governmental and nonprofit organizations must follow the audit requirements of OMB Circular 2 CFR Part 200.

All audits shall conform to generally accept auditing and accounting standards and MDA policies and procedures. A copy of each year's financial audit report, which provides a specific reference to this contract, shall be mailed to MDA within one week after its receipt by the local unit of government. All audit reports shall be finalized within six months after the contract's ending date unless an alternative date is agreed to in writing by MDA. All audit costs shall be the local unit of government's responsibility.

Failure to submit all Audit documentation by the required due dates may deem the Local Units of Government or Non-Profit Organizations in non-compliance with the Audit Requirements. **CID may impose sanctions such as suspending payments of current grants until the Audit is received and/or the eligibility for future funding.**

3. Leveraged Funds

- a. The Subgrantee is held to its leveraged fund commitment as stated in the approved application.
- b. Should a portion of the matching funds not be required (i.e., low bids, MDA approved change in scope of work), MDA, Community Incentives Division, will reduce the grant proportionately so that the leveraging ratio holds constant regardless of how funds are budgeted.

4. In-Kind Services

If applicable, any in-kind services to be performed by the Subgrantee or others designated as local match funds must be adequately documented or make actual dollar contributions to provide for the local match funds.

5. Request for Cash

When submitting a request for cash, the subgrantee must provide the Request for Cash form sheet and the CDBG Consolidated Support Sheet. Drawdowns should be made only in the amount necessary to meet current disbursement needs. A zero balance must be maintained and funds disbursed within three (3) days.

6. Cost Overruns

The subgrantee agrees to and understands that the CDBG award is limited to the amount under this agreement. Any cost overruns will be the sole responsibility of the subgrantee.

7. Budget Revision Acceptance

The Subgrantee agrees and accepts all changes to the budget pages of its CDBG application; and the revised budget forms attached to this contract shall constitute the true and correct budget for the Subgrantee's CDBG project, and are hereby incorporated by reference herein and made a part of this contract.

8. Availability of Funds

This contract is contingent on the availability of funds from the U.S. Department of Housing and Urban Development.

9. Procurement

The local unit of government must comply with all State and Federal laws per 2 CFR Part 200 dealing with purchasing and acquisition for goods, services and other allowable cost as specified in the application. All procurements transactions, regardless of dollar amount, must be conducted in a manner to provide free and open competition

10. Close-out Package

Within 30 days after the completion of all activities or 60 days after the expiration of the grant agreement, the subgrantee must submit a complete and acceptable close-out package.

**SPECIAL PROVISIONS AND REGULATIONS STIPULATED BY
THE U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)
COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG) PROGRAM**

1. Access of Grantee, State of Mississippi, HUD and Others to CDBG Documents, Papers, & Books

The Contracted Party agrees to allow the Grantee, State of Mississippi, HUD, the Comptroller General of the United States, and any of their duly authorized representatives access to any books, documents, papers, and records of the Contracted Party which are directly pertinent to the CDBG Program for the purpose of making audits, examinations excerpts, and transcriptions

2. Termination of Contract For Cause

If, through any cause, the Contracted Party shall fail to fulfill in timely and proper manner, his obligations under this Contract, or if the Engineer shall violate any of the covenants, agreements, or stipulations of this Contract, the Grantee shall thereupon have the right to terminate this Contract by giving written notice to the Contracted Party of such termination and specifying the effective date of such termination. In such event, all finished or unfinished documents data, studies, and reports prepared by the Contracted Party shall entitle the Contracted Party's receipt of just and equitable compensation for any satisfactory work completed on such documents. Notwithstanding the above, the Contracted Party shall not be relieved of liability to the Grantee for damages sustained or the Grantee by virtue of any breach of the Contract by the Contracted Party. The Owner may withhold any payments to the Contracted Party for the purpose of set off until such time as the exact amount of damages due the Grantee from the Contracted Party is determined

3. Termination for Convenience of the Grantee

The Grantee may terminate this Contract any time by a notice in writing from the Grantee to the Contracted Party. If the Contract is terminated by the Owner as provided herein, the Contracted Party will be paid an amount which bears the same ratio to the total compensation as the services actually performed bear to the total services of the Contracted Party covered by this Contract, less payments of compensation previously made provided that if less than sixty percent of the services covered by this Contract have been performed upon the effective date of such termination, the Contracted Party shall be reimbursed (in addition to the above payment) for that portion of actual out-of-pocket expenses (not otherwise reimbursed under this Contract) incurred by the Contracted Party during the Contract period which are directly attributable to the incomplete portion of the services covered by this Contract.

4. Record-Keeping

All records required to be kept on the project shall be maintained for at least three (3) years after final payments and until all other pending matters under the grant are closed.

5. Health and Safety Standards

All parties participating in this project agree to comply with Section 107 of the Contract Work Hours and **Safety Standards Act**. Section 107 of the Act is applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction, safety, and health standards promulgated by the Secretary of Labor. These requirements do not apply to the purchase of supplies or materials or articles ordinarily available on the open market, or contracts for transportation.

6. Uniform Relocation Act Requirements

The Contracted Party will comply with all applicable requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4630) as specified in regulations issued by the Secretary of the Department of Housing and Urban Development and published in 24 CFR 570-1.

7. Citizens Participation

The Subgrantee must follow the Citizen Participation procedures in accordance with the requirements listed in Title 24 CFR 91.115 of the Housing and Community Development Act of 1974, as amended. The Act provides for and encourages, Citizen Participation and emphasizes participation by persons of low and moderate income, particularly residents of predominantly low- and moderate-income neighborhoods, slum or blighted areas, and areas in which the State of Mississippi proposes to use federal funds.

8. Environmental Compliance (performed outside of this contract)

Environmental clearance must be completed within four (4) months of the award date or the contract will be voided unless the Division Director authorizes a waiver. Notwithstanding any provision of this Agreement, the parties hereto agree and acknowledge that this agreement does not constitute a commitment of funds or site approval, and that such commitment of funds or approval may occur only upon satisfactory completion of environmental review and receipt by recipient of a release of funds from the Mississippi Development Authority under 24 CFR Part § 58. The parties further agree that the provision of any funds to the project is conditioned on the recipient's determination to proceed with, modify or cancel the project based on the results of a subsequent environmental review. No project costs shall be paid by CID prior to environmental clearance except for Application Preparation.

Contracts, subcontracts, and subgrants of amounts in excess of \$100,000.00 shall contain a provision which requires compliance with all applicable standards, orders, or requirements issued under Section 306 of the **Clean Air Act** (42 U.S.C. 1957 (h)), Section 508 of the **Clean Water Act** (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency (EPA) regulations (40 CFR, 15), which prohibit the use under nonexempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities.

The provisions shall require reporting of violations to the grantor agency and the U.S. EPA Assistant Administrator for Enforcement (EN-329) Contracts, subcontracts, and subgrants of amounts in excess of \$100,000.00 shall contain a provision which requires compliance with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 U.S.C. 1957 (h)), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency (EPA) regulations (40 CFR, 15), which prohibit the use under nonexempt Federal contracts, grants, or loans of facilities included on the EPA List of Violating Facilities. The provisions shall require reporting of violations to the grantor agency and the U.S. EPA Assistant Administrator for Enforcement (EN-329)

9. Historic Preservation (Not applicable, new construction)

Both parties agree to assist the Federal grantor agency in its compliance with Section 106 of the National Historic Preservation Act of 1966 as amended (16 USC 470), Executive Order 11593, and the Archaeological and Historic Preservation Act of 1966 (16 USC 469a-1 *et seq.*) by (a) consulting with the State Historic Preservation officer on the conduct of investigations, as necessary, to identify properties listed in or eligible for inclusion in the National Register of Historic Places that are subject to adverse effects (CFR Part 600.8) by the activity, and notifying the Federal grantor agency of the existence of any such properties, and by (b) complying with all requirements established by the Federal grantor agency and the state grantor agency to avoid or mitigate adverse effects upon such properties

10. Lead-Based Paint Requirements (Not applicable, new construction)

The Contracted Party will comply with Title IV of the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4831) which prohibits the use of lead-based paint in residential structures constructed or rehabilitated with Federal assistance in any form.

11. Labor Standards - Davis-Bacon Act Requirements (shall be incorporated into bid documents)

The Contracted Party will comply with Section 110 of the Housing and Community Development Act of 1974, as amended, which requires that all laborers and mechanics employed by contractors or subcontractors on construction work assisted under the Act shall be paid at rates not less than those prevailing on similar construction in the locality as determined by the Secretary of Labor in accordance with the Davis-Bacon Act, as amended 40 U.S.C. 276a-276-a5), and it will comply with the Contract Work Hours and Safety Standards Act (40 U.S.C. 327 *et seq.*). However, these requirements apply to the rehabilitation of residential property only if such property is designed for residential use of eight or more families.

12. Energy Efficiency

All participants in the projects shall recognize mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (PL 94-163).

13. Changes

The Grantee may, from time to time, request changes in the scope of the services of the Contracted Party to be performed hereunder. Such changes, including any increase or decrease in the amount of the Contracted Party's compensation which are mutually agreed upon by and between the Grantee and the Contracted Party, shall be incorporated in written amendments to this Contract.

14. Personnel

The Contracted Party represents that it has, or will secure at its own expense, all personnel required in performing the services under this Contract. Such personnel shall not be employees of or have any contractual relationship with the Grantee. All the services required hereunder will be performed by the Contracted Party or under its supervision, and all personnel engaged in the work shall be fully qualified and shall be authorized or permitted under State and local law to perform such services. No person who is serving sentence in a penal or correctional institution shall be employed on work under this Contract.

15. Anti-Kickback Rules (shall be incorporated into bid documents)

Salaries of personnel performing work under this Contract shall be paid unconditionally and not less often than once a month without payroll deduction or rebate on any account except only such payroll deductions as are mandatory by law or permitted by the applicable regulations issued by the Secretary of Labor pursuant to the "Anti-Kickback Act" of June 13, 1934 (48 Stat. 948; 62 Stat. 740; 63 Stat. 108; Title 18 U.S.C. 874; and Title 40 U.S.C. 276c). The Engineer and contractor shall comply with all applicable "Anti-Kickback" regulations and shall insert appropriate provisions in all subcontracts covering work under this contract to ensure compliance by the subcontractors with such regulations, and shall be responsible for the submission of affidavits required of subcontractors thereunder except as the Secretary of Labor may specifically provide for variations of or exemptions from the requirements thereof.

16. Withholding of Salaries

If in the performance of this Contract, there is any underpayment of salaries by the Contracted Party or by any subcontracted thereunder, the Grantee shall withhold from the Contracted Party out of payment due to him an amount sufficient to pay to employees underpaid the difference between the salaries required thereby to be paid and the salaries actually paid such employees for the total number of hours worked. The amounts withheld shall be disbursed by the Grantee for and on account of the contracted party or subcontractor to the respective employees to whom they are due.

17. Claims and Disputes Pertaining to Salary Rates

Claims and disputes pertaining to salary rates or to classifications of professional staff or technicians performing work under this Contract shall be promptly reported in writing by the Contracted Party to the Grantee for the latter's decision which shall be final with respect thereto.

18. Equal Employment Opportunity

During the performance of this Contract, the Contracted Party agrees to comply with Executive Order 11246, and the regulations issued pursuant thereto (24 CFR 130 and 41 CFR Chapter 60), which provides that no person shall be discriminated against on the basis of race, color, religion, gender, or national origin in all phases of employment during the performance of Federal or Federally assisted construction contracts, contractors and subcontractors on Federal and Federally assisted construction contracts shall take affirmative action to ensure fair treatment in employments, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination, rates or pay or other forms of compensation and Section for training apprenticeship.

19. Section 3

Section 3 of the Housing and Urban Development Act of 1968, is a statutory provision which requires that, to the greatest extent feasible, opportunities for training, employment, contracting and other economic opportunities be given to low and very- low-income residents of the project area and contracts for work in connection with the project be awarded to eligible business concerns which are located *in*, or owned in substantial part, by persons residing in the project area. The Sub-recipient and contractors must demonstrate a good faith effort and document compliance as set-forth by 24 CFR 135.

20. Anti-Discrimination Clauses

The Contracted Party will comply with the following clauses:

- a. Title VI of the Civil Rights Act of 1964 (PL 88-352), and the regulations issued pursuant thereto (24 CFR 1), which provides that no person in the United States shall on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives Federal financial assistance and will immediately take any measures necessary to effectuate this assurance. If any real property or structure thereon is provided or improved with the aid of Federal financial assistance extended to the applicant, this assurance shall obligate the applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the Federal financial assistance is extended, or for another purpose involving the provision of similar services or benefits;
- b. Title VIII of the Civil Rights Act of 1968 (PL 90-284), as amended, administering all programs and activities relating to housing and community development in a manner to affirmatively further fair housing, and taking action to affirmatively further fair housing in the sale or rental of housing, the financing of housing, and the provision of brokerage services. This requirement dictates some form of action to be taken by the grantee, not just passive compliance with existing laws and ordinances. Fair housing choice is the ability of persons of similar *income* levels to have available to them a like range of housing choices regardless of race, color, national origin, religion, sex,

familial status, or disability. CDBG grantees make a commitment to Affirmatively Further Fair Housing in the community as a recipient of CDBG funds. It is important for grantees to be aware that this is a commitment to understand every individual's fair housing rights and ensure all local policies and practices do not hinder fair housing and when appropriate actively further fair housing.; and,

- c. Executive Order 11063, as amended by Executive Order 12259, on equal opportunity in housing and nondiscrimination in the sale or rental of housing built with Federal assistance.
- d. Section 109 of the Housing and Community Development Act of 1974, as amended which requires that no person in the United States shall on the grounds of race, color, national origin, or gender be excluded from participation in, be denied the benefits or be subjected to discrimination under, any program or activities funded in whole or in part with community development funds made available pursuant to the Act. Section 109 further provides that any prohibition against discrimination on the basis of age under the Age Discrimination Act of 1975 (42 U.S.C. 6101 et seq.) or with respect to an otherwise qualified handicapped individual as provided in Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 796) shall also apply to any such program or activity.

21. Architectural Barriers Act and Americans with Disabilities

The contracted parties will comply with the Architectural Barriers Act and the Americans with Disabilities as described in 24 CFR Sec 487 (e).

22. Discrimination Because of Certain Labor Matters

No person employed on the work covered by this Contract shall be discharged or in any way discriminated against because he has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable hereunder to his employer.

23. Compliance with Local Laws

The Contracted Party shall comply with all applicable laws, ordinances, and codes of the state and local governments, and shall commit no trespass on any public or private property in performing any of the work embraced by this Contract.

24. Subcontracting

None of the services covered by this Contract shall be subcontracted without prior written consent of the Grantee. The Contracted Party shall be as fully responsible to the Grantee for the acts and omissions of his subcontractors and of persons either directly or indirectly employed by him. The Contracted Party shall insert in each subcontract appropriate provisions requiring compliance with the labor standards provisions of this Contract.

25. Assignability

The Contracted Party shall not assign any interest in this Contract, and shall not transfer any interest in the same (whether by assignment or novation) without prior written approval of the Grantee provided that claims for money due or to become due the Contracted Party from the Grantee under this Contract may be assigned to a bank, trust company, or other financial institution, or to a Trustee in Bankruptcy, without such approval. Notice of any such assignment or transfer shall be furnished promptly to the Grantee.

26. Conflict of Interest of Members of Local Public Agency and Others

The Contracted Party agrees to establish safeguards to prohibit employees from using positions for a purpose that is or give the appearance of being motivated by a desire for private gain for themselves or others, particularly those with whom they have a family, business, or other tie. The Contracted Party will comply with Section 25-4-105, Mississippi Code Annotated (1972), which prohibits any public servant from using his official position to obtain pecuniary benefit for himself other than compensation provided for by law or for any relative or business with which he is associated and which further provides that a public servant may not be interested, during the term for which he has been chosen, or within one (1) year thereafter, in any contract made or let by the governing authorities of such municipality for the construction or doing of any public work, or for the sale or purchase of any materials, supplies or property of any description, or for any other purpose whatsoever, or in any subcontract arising therefrom or connected therewith, or to receive, either directly or indirectly, any

portion or share of any money or other thing paid for the construction or doing of any public work, or for the sale or purchase of any property, or upon any other contract made by the governing authorities of the municipality, or subcontract arising therefore or connected therewith.

The Contracted Party will also be aware of and avoid any violation of Section 24-4-117 and 25-4-119, Mississippi Code Annotated (Supp. 1972), which prescribes a criminal penalty for any public servant convicted of a violation of this Ethics in Government section.

27. Interest of Certain Federal Officers

No member of or delegate to the Congress of the United States and no Resident Commissioner, shall be admitted any share or part of this Contract or to any benefit to arise therefrom.

28. Interest of Contractor

The Contracted Party covenants that he presently has no interest and shall not acquire any interest direct or indirect in the above-described project or any parcels therein or any other interest which would conflict in any manner or degree with the performance of his services hereunder. The Contracted Party further covenants that in the performance of this Contract no person having any such interest shall be employed.

29. Political Activity

~~The Contracted Party will comply with the provisions of the Hatch Act (5 U.S.C. 1501 et seq.), which limits the political activity of employees.~~

30. Compliance with Office of Management and Budget

The parties agree to comply with the regulations, policies, guidelines, and requirements of the Office of Management and Budget, Circulars A-95, A-102, and A-54, as they relate to the use of Federal funds under this contract.

31. Flood Insurance Purchase Requirements

Both parties agree to comply with the flood insurance purchase requirements of Section 102(2) of the Flood Disaster Protection Act of 1973, (PL 93-234, 87 Stat. 975) approved December 31, 1976. Section 102 (a) requires, on and after March 2, 1975, the purchase of flood insurance in communities where such insurance is available as a condition for the receipt of any Federal financial assistance for construction or acquisition purposes for use in any area that has been identified by the Secretary of the Department of Housing and Urban Development as an area having special flood hazards. The phrase, "Federal financial assistance," includes any form of loan, grant, guaranty, insurance payment, rebate, subsidy, disaster assistance loan or grant, or any other form of direct or indirect Federal assistance.

32. Program Monitoring

Both parties agree to assist and cooperate with the Federal grantor agency and the state grantor agency or their duly designated representatives in the monitoring of the project or projects to which this grant relates, and to provide in form and manner approved by the state grantor agency such monitoring reports, progress reports, and the like as may be required and to provide such reports at the times specified.

33. Discrimination Due to Beliefs

No person with responsibilities in operation of the project to which this grant relates will discriminate with respect to any program participant or any applicant for participation in such program because of political affiliation or beliefs.

67Confidential Findings

All of the reports, information, data, etc., prepared or assembled by the Contracted Party under this Contract are confidential, and the Contracted Party agrees that they shall not be made available to any individual or organization without prior written approval of the Grantee.

34. Third-Party Contracts

The Subgrantee shall include in all contracts with Participating Parties receiving grant funds provisions requiring the following:

- a. Each such Participating Party keeps and maintains books, records, and other documents relating directly to the receipt and disbursement of such grant funds; and,
- b. Any duly authorized representative of the Mississippi Development Authority, the U.S. Department of Housing and Urban Development, and the Comptroller General of the United States shall, at all reasonable times, have access to and the right to inspect, copy, audit, and examine all such books, records, and other documents of such Participating Party until the completion of all close-out procedures respecting this grant and the final settlement and conclusion of all issues arising out of this grant.

The Subgrantee shall include in all contracts with Participating Parties a provision that each Participating Party agrees that any duly authorized representative of the Mississippi Development Authority, the U.S. Department of Housing and Urban Development, and the Comptroller General of the United States shall, at all reasonable times, have access to any portion of the Project in which such Participating Party is involved until the completion of all close-out procedures respecting this grant.

35. Excessive Force

~~The contracted parties will adopt and enforce a policy of prohibiting the use of excessive force by law enforcement agencies within its jurisdiction against any individuals engaged in nonviolent civil rights demonstrations; and enforcing applicable State and local laws against physically barring entrance to or exit from a facility or location which is the subject of such nonviolent civil rights demonstrations within its jurisdiction.~~

BYRD ANTI-LOBBYING

AMENDMENT

(also incorporated into bid documents)

Contractors who apply or bid for an award of \$100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, officer or employee of Congress, or an employee of a Member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient who in turn will forward the certification (s) to the awarding agency.

APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING – REQUIRED FOR CONTRACTS OVER \$100,000

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

APPENDIX “B”
WAGE RATES, DAVIS-BACON ACT

PART 1 - GENERAL

1.01 SUMMARY

- A. Following this page is a list of the current Davis-Bacon wage rates for Tippah County, Mississippi.
- B. It is the Contractor’s responsibility to check www.sam.gov for the most current wage rates prior to each pay period.

END OF SECTION

State: Mississippi

Construction Types: Building

Counties: Mississippi Counties of
Alcorn, Calhoun, Chickasaw, Choctaw,
Clay, Lee, Lowndes, Monroe, Noxubee,
Oktibbeha, Pontotoc, Prentiss, Tippah,
Tishomingo, Union, Webster and Winston

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ELEC0852-003 01/01/2025

	Rates	Fringes
ELECTRICIAN (INCLUDES LOW VOLTAGE WIRING, HVAC/TEMPERATURE CONTROLS INSTALLATION AND WIRING).. \$ 28.80		14.14

IRON0167-012 05/01/2024

	Rates	Fringes
IRONWORKER, STRUCTURAL..... \$ 30.00		19.58

PLUM0568-003 11/01/2024

	Rates	Fringes
PLUMBER..... \$ 30.41		11.47

SUMS2015-006 04/03/2017

	Rates	Fringes
TRUCK DRIVER: DUMP TRUCK..... \$ 13.92		1.91
SHEET METAL WORKER, INCLUDES HVAC DUCT INSTALLATION.. \$ 21.86		11.18
PIPEFITTER..... \$ 22.77		6.96
PAINTER (BRUSH AND ROLLER)..... \$ 15.17		0.00
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE..... \$ 18.00		0.00
LABORER: PIPELAYER..... \$ 12.52		0.75
LABORER: MASON TENDER - CEMENT/CONCRETE..... \$ 12.98		0.00
LABORER: COMMON OR GENERAL..... \$ 11.36		0.00
ELEVATOR MECHANIC..... \$ 36.28		29.69
CEMENT MASON/CONCRETE FINISHER..... \$ 20.00		0.00
CARPENTER..... \$ 16.13		0.00

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave
for Federal Contractors applies to all contracts subject to the
Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than **◆SU◆**, **◆UAVG◆**, **◆SA◆**, or **◆SC◆** denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE:

UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The **SU** identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

SU wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The **SA** identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the **SA** identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

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APPENDIX “C”

ARC IMPLEMENTATION GUIDE FOR BUILD AMERICA, BUY AMERICA

PART 1 - GENERAL

1.01 SUMMARY

- A. Following this page is the Appalachian Regional Commission Interim Implementation Guidance on the Application of the Buy America Preference in ARC Grants.
- B. The Contractor shall abide by these provisions.
- C. These provisions will be attached to the Owner-Contractor Agreement as an exhibit.

END OF SECTION

APPALACHIAN REGIONAL COMMISSION

Interim Implementation Guidance on the Application of the Buy America Preference in ARC Grants for Infrastructure

On May 5, 2022, ARC notified the implementation of the domestic content procurement preference (Buy America) provided in the Build America, Buy America Act, starting on May 14, 2022. The new requirement in ARC grants for infrastructure projects means that, 1-all of the iron and steel in the project is produced in the United States, 2-the manufactured products used in the project are produced in the United States, and 3- the construction materials used in the project are produced in the United States. This interim guidance describes the type of projects subject to the Buy America requirements and the process to request waivers.

I. Applicability:

This guidance applies to all ARC grants whether or not funded through Infrastructure Investment and Jobs Act, Pub. L. No. 117-58 (IIJA)—where funds are made available and used in the infrastructure portion of all grants involving infrastructure. It will also apply to subawards made with ARC grants.

The Buy America preference applies to an entire infrastructure project, even if it is funded by both Federal and non-Federal funds under one or more awards. The Buy America preference only applies to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. It does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America preference apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of or permanently affixed to the structure.

II. Definitions:

1. **Construction materials** includes an article, material, or supply— other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives — that is or consists primarily of: non-ferrous metals; plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables); glass (including optic glass); lumber; or drywall.
2. **Domestic content procurement preference-** The term “domestic content procurement preference” means all iron and steel used in the project are produced in the United States; the manufactured products used in the project are produced in the United States; or the construction materials used in the project are produced in the United States.

3. **Infrastructure-** The term infrastructure encompasses public infrastructure projects. Thus, the term “infrastructure” includes, at a minimum, the structures, facilities, and equipment for roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property.

In determining whether a particular construction project constitutes “infrastructure” for purposes of the Buy America requirement, the ARC will consider whether the project will serve a public function, including whether the project is publicly owned and operated, privately operated on behalf of the public, or is a place of public accommodation, as opposed to a project that is privately owned and not open to the public. Projects with the former qualities have greater indicia of infrastructure, while projects with the latter quality have fewer. If ARC determines that no funds from a particular grant will be used for infrastructure, a Buy America preference does not apply to that grant award.

4. **Produced in the United States-** The term produced in the United States means-
(A) in the case of iron or steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
(B) in the case of manufactured products, that (i) the manufactured product was manufactured in the United States; and (ii) the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
(C) in the case of construction materials, that all manufacturing processes for the construction material occurred in the United States.
5. **Project-** The term project means construction, alteration, maintenance, or repair of infrastructure.

III. Waivers

ARC may waive the application of the Buy America preference in any case in which the Federal Co-Chair finds that—

- (1) applying the domestic content procurement preference would be inconsistent with the public interest (a “public interest waiver”);
- (2) types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality (a “non-availability waiver”); or

(3) the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent (an “unreasonable cost waiver”).

A. Non-availability Waivers

In considering a request for a non-availability waiver, ARC will assess whether the recipient or subrecipient performed a thorough market research and adequately considered, where appropriate, qualifying alternate items, products, or materials.

B. Unreasonable Cost Waivers

In considering a request for an unreasonable cost waiver, ARC will examine whether the recipient or subrecipient has provided adequate documentation that no domestic alternatives are available within the cost parameter. An unreasonable cost waiver is available if the inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent. The waiver justification must include, as applicable, a comparison of the cost of the domestic product to the cost of the foreign product or a comparison of the overall cost of the project with domestic products to the overall cost of the project with foreign-origin products. Publicly available cost comparison data may be provided in lieu of proprietary pricing information.

C. Public Interest Waivers

ARC may issue public interest waivers when it determines that its statutory mandate and policy goals cannot be achieved consistent with the Buy America requirements and the proposed waiver would not meet the requirements for a non-availability or unreasonable cost waiver. ARC may consider issuing general applicability public interest waivers in the interest of efficiency and to ease burdens for recipients or subrecipients.

IV. Process to Request a Waiver

ARC sponsored construction projects administered by a Federal Basic Agency will follow the policies and procedures of the Federal Agency for Buy American waivers. ARC sponsored construction projects administered by a Registered State Basic Agency that follows the policies and procedures of a Federal agency in administering an ARC grant will follow the policies and procedures for Buy America waivers as determined by said Federal agency. Whenever a construction project is co-funded by a Federal agency and ARC, the grantee and subgrantee will follow the processes and procedures for Buy America waivers of the Federal agency. In the event that two or more Federal agencies participate in funding an infrastructure project, the grantee or subgrantee will follow the policies and procedures for Buy America of the Federal agency with the highest contribution of funds to the project.

The following process will apply in those circumstances not covered in the previous paragraph. ARC grant recipients and subrecipients will submit their request for Buy America waivers in writing (email) to the ARC project coordinator and the administering agency point of contact. All waiver requests must include a detailed justification for the use of goods, products, or materials mined, produced, or manufactured outside the United States and a certification that there was a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with potential suppliers.

The request for a Buy America waiver must include, at a minimum and to the greatest extent practicable, the following information:

- Waiver type (non-availability, unreasonable cost, or public interest)
- Recipient name and Unique Entity Identifier (UEI)
- ARC program name (POWER, INSPIRE, BWI, DCI)
- ARC Grant Award Identification Number
- ARC and Federal financial assistance (if applicable) funding amount
- Total cost of infrastructure expenditures, including all Federal and non-Federal funds (to the extent known)
- Infrastructure project description and location
- List of iron or steel item(s), manufactured products, and construction material(s) proposed to be excepted from Buy America requirements, including name, cost, and country(ies) of origin (if known).
- A certification that the recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with the prime contractor.
- A statement of waiver justification, including a description of efforts made (e.g., market research, industry outreach), by the recipient, in an attempt to avoid the need for a waiver. Such a justification may cite, if applicable, the absence of any Buy America-compliant bids received in response to a solicitation.
- Anticipated impact if no waiver is issued.

ARC will consider request for waivers on a case-by-case basis. The grantee or subgrantee must promptly submit the request for a Buy America waiver upon having the documentation to support the request for the waiver and not less than 60 days prior to the expected day for starting construction.

In issuing a waiver on Buy America, ARC will consider the statutory provisions of the Build America, Buy America Act, the Appalachian Regional Development Act of 1965, as amended,

the Guidance of the U.S. Office of Management and Budget (OMB), and its mission and policy goals described in its Strategic Fiscal Plan for Fiscal Years 2022-2026. ARC Buy America waiver determinations will be notified to the grantees or subgrantees by the ARC project coordinator in writing.

V. Buy America Guidance Updates

ARC would be updating this Buy America guidance, that is applicable to the infrastructure portion of all grants involving infrastructure, as new guidelines are issued by the OMB and the Made in America Office, including but not limited to the final standards on construction material.